OMNI

AUGUST 1981 $2.00

SPACE LAWS OF THE ROMAN EMPIRE

ASIMOV'S NEUTRINO AND THE COLLAPSIBLE UNIVERSE

THE RIGHT TO DIE

PRIMAL GARDENS FROM GENETIC MEMORIES

AND A NEW VIEW OF HUMAN SEXUAL COMPATIBILITY

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AUGUST 1981

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John Holmes, a self-taught artist, is the creator of this month's cover. Titled The Seer, *the painting depicts man's ability to peek into an existential future. Holmes's paintings are in private collections throughout the world, and he is now working for clients in Europe, the United States, and Australia.*

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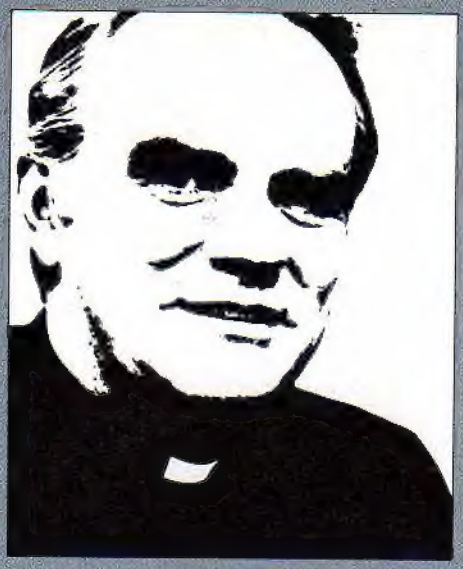

FIRST WORD

By John G. Driscoll, C.F.C.

"An individual must have the tools to make decisions before he can take part in the democratic process."

President Reagan's new budget programs might have an unanticipated and pernicious effect on the future of this country. He and his counselors believe that the revitalization of our industrial and military establishments will stimulate the economy. It is worrisome and puzzling that this same pro-industrial strategy calls for the elimination of educational programs designed to train citizens with scientific and engineering talent. I refer specifically to the Reagan Administration's decision to reduce drastically the activities of the National Science Foundation.

This cutback could severely affect science education, a grievous concern since we belong to a global society in which it is increasingly important economically, socially, and politically for citizens to have an understanding of science and technology. It is already widely reported that the level of science education in our secondary schools is below that of the other industrial nations. For example, 85 percent of American high-school students discontinue their studies in science and mathematics after grade ten. In contrast, two thirds of the tenth-graders in the Soviet Union are completing two years of calculus. Our technological society — which needs the support of strong moral values, a disciplined education, and an adequate information base — cannot achieve its complex goals with such an inadequate preparation of its citizens.

The administration's assault on the programs of the National Science Foundation further complicates a serious condition that already exists within America. We are rapidly seeing the growth of two social classes, the science-blind and the science-capable: those who have been educated exclusively in the humanities, law, or business and those who have been trained specifically in science and technology. The existence of these two essentially different groupings introduces considerable stress into our economic, political, and ethical decision-making processes.

Presently we are witnessing a wonderful reawakening of curiosity and interest in the sciences. The success of magazines such as *Omni* and the production of numerous science and science-fiction books, movies, and television programs demonstrate wide support for the sciences. While some who read these publications and enjoy these programs are knowledgeable about the sciences, most people do not have the background to understand and interpret technological information in a way that will let them judge and adjust in a society being transformed by rapid change. Without an appreciation of how complex the technological disciplines and basic literacies are, these individuals are woefully unprepared, unable to act prudently, and effectively unable to understand issues and options.

Inability to act generally spawns a paralyzing fear, so that ignorance of science, technology, and sophisticated techniques of problem-solving fosters suspicion and distrust of our scientists' and technologists' motivations. We are in danger of the public's perceiving these experts as Dr. Strangeloves, intent on manipulation for purposes not congruent with democratic goals and objectives.

Inadequate educational experiences pose a direct threat to the democratic system. The right of the people to govern themselves is founded on the conviction that each citizen can in fact make intelligent decisions about the issues that affect his life. Today many of the policies set by the public and private sectors are affected by developments in the areas of science and technology. Unless each individual has an adequate understanding of the complexities of these issues and has the appropriate tools with which to decide, he is incapable of exercising his role in the democratic process. He must instead resign himself to surrendering his responsibility to a comparatively small elite, a course of action basically antithetical to the American democratic experience.

Only through education can we hope to develop a citizenry that is prepared to participate actively in a rapidly developing technological society. Emphasis on literacy, "numeracy," and appropriate academic and personal discipline must be made a priority. Additional curricula must be studied, much of it with newer pedagogical techniques. Professional, prepared teachers must lead the way.

This is happening at some learning centers. At Iona College, in New Rochelle, New York, the faculty, administration, and authorities in science and technology have been involved in developing lecture and laboratory experiences that would provide every undergraduate with the opportunities needed to address issues of health, energy, environment, information retrieval, data and word processing, risk analysis, and decision making — major concerns of today and tomorrow.

Appropriate change must be expected and required of that extraordinarily large and fine network, the American educational system. This change mandates two partners for the educational community: a corporate sector that can provide financial assistance to make educational changes feasible and a government sector that will respond with more perception and precision when the citizens speak. ∞

Dr. Driscoll is the president of Iona College, in New Rochelle, New York.

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OMNIBUS

ASIMOV

KLEIN

STEWART

WILLIAMS

The great fortunes of the next century will be made in the asteroid belt, and, by the year 2020, a significant fraction of humanity's gross world product will be derived from space-based activities," claims Art Dula, probably the first private attorney in America to devote his practice entirely to aerospace and technical law. "Cosmic Counselor," *Ron Bitto*'s profile of the Texan space lawyer, begins on page 48.

Bitto, while working full-time as the advertising manager for Eastman Whipstock, Inc., a directional oil-drilling company in Houston, is a ghost writer for engineers in his free time. Possessing a liberal arts background, Bitto has been successful in translating highly technical subjects into understandable copy. Many oilfield trade publications have published his articles.

If the universe begins to collapse, what will happen? Will it end as a small, dense point? Or will it bounce and begin expanding again? The key to this mystery may be the neutrino, a neutrally charged, massless particle capable of going through more than 20 light-years of lead without being stopped. In "The Very Large Lion and the Very Small Mouse" (page 78), *Isaac Asimov*, the dean of science writers, discusses why the "tiniest mouse," the neutrino, may finally tame the "largest lion," the universe.

Asimov has published more than 200 books. His most recent are *In the Beginning* (Crown), a masterful appraisal of the first 11 chapters of Genesis, and *Asimov on Science Fiction* (Doubleday), a collection of essays on topics relevant to science fiction.

"Each of us worries to some degree about the circumstances of his or her own death," says writer *Roger M. Williams*. "Will it be protracted and painful? Will those who want to die be prevented from doing so by doctors or well-meaning relatives who want to maintain life at any cost?" These are some of the weighty questions Williams asks in "This Way Out" (page 44).

Williams, formerly head of the Atlanta bureau for *Time* magazine, senior editor at *Saturday Review*, and staff writer for *Sports Illustrated*, has contributed to a variety of national publications, including the *Dial*, *Signature*, the *Nation*, and the *Atlantic*. He is the author of *Sing a Sad Song: The Life of Hank Williams*, recently reissued in hardcover by the University of Illinois Press, and *The Bonds: An American Family* (Atheneum), which traces the lives of Julian Bond and his forebears.

The line from Arthur C. Clarke's book *Voices from the Sky*, "The rash assertion that 'God created man in His own image' is ticking like a time bomb at the foundations of many faiths," stirred *Ben Bova* to write *Voyagers*. An exclusive excerpt from the novel, to be published this month by Doubleday, begins on page 52.

Other fiction this month includes *Ian Stewart*'s "The Microbotic Revolution" (page 62). Stewart, who is a lecturer in mathematics at the University of Warwick, in Coventry, England, has written for *New Scientist*, *Scientific American*, and the *Times Literary Supplement*. Stewart's "Message from Earth" appeared in our February 1980 issue.

If the Donald Symons interview (March 1981) caused you to wonder about some of the theories espoused by sex therapists in this country, read *Diane Klein*'s interview with sex researcher Helen Singer Kaplan (page 72) for more mindblowing insights into that touchy issue.

Klein, a free-lance writer for a variety of magazines, has written several articles on sexuality for *Modern Bride*. She, unlike those hapless mates discussed in her interview, has been happily married to one man for 28 years.

Are you a genius? Last month *Omni* published an I.Q. test prepared especially for the magazine by representatives of Mensa, the high-I.Q. society. Beginning on page 88, you will find the test answers, along with an analysis of the results.

Through the ages, storytellers have created many different names for Eden, the originally perfect paradise. "Green World," beginning on page 56, is a collection of Friedrich Hechelmann's paintings of that prehuman world. Hechelmann, the painter who created our December 1978 cover, resides in Isny im Allgau, West Germany. He is a former student of Rudolf Hausner, one of the masters of the Viennese school of fantastic realism. The text is by *Robert Sheckley*, *Omni*'s fiction editor.

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AUGUST

LETTERS

COMMUNICATIONS

Contributors Write In

The painting by Cristobal Toral illustrating my story "Angel at the Gate" [June 1981] was stunning. Now I understand why I lock myself away in my study while everyone else is at the beach. There just aren't any better showcases for fiction than *Omni*.

Russell M. Griffin
Milford, Conn.

The illustration for "Colonel Stonesteel's Genuine Home-made Truly Egyptian Mummy" [May 1981] was glorious. I'm proud of having my story in *Omni*.

Ray Bradbury
Los Angeles, Calif.

Many thanks for Ellen Datlow's eloquent words accompanying "Stellar Technician" [May 1981]. I was pleased and flattered. Now if only I could live up to them.

Vincent Di Fate
Wappingers Falls, N.Y.

Dali on Lincoln

As president of the Salvador Dali Foundation, Inc., in St. Petersburg, Florida, and as owner of the world's largest collection of Dali, I read with great interest your article on Dali's painting of Abraham Lincoln [Games, May 1981].

Lincoln in Dali Vision was based on Leon Harmon's computer-reproduced illustration of Matthew Brady's original portrait of Lincoln, which appeared in a *Scientific American* article on the computerization of images and the human mind's ability to retain images.

Dali took the image from that magazine, blew it up to approximately ten feet high by eight feet wide, and then painted directly on the paper. The photographic illustration is displayed in Dali's Teatro Museo, in Figueras, Spain. It is very popular. Visitors can view it through a pair of binoculars from across the lobby.

When we first exhibited the print at the Dali Foundation (then in Cleveland, Ohio), I hung a Xerox copy of the Harmon work and the reference beside the illustration to demonstrate how the image was derived. I then received a call from Dr. Harmon's lawyer, who thought that Harmon should be given credit for the concept. Since the picture was sold and profits were made from reproductions, we felt it should be acknowledged that Harmon's intellectual property was the basis for this image and the inspiration for Dali's.

Subsequently Dali has become ill, and we have been unable to conclude whether he wants to acknowledge Dr. Harmon's contribution.

A. Reynolds Morse
Salvador Dali Foundation, Inc.
St. Petersburg, Fla.

Psychic Archaeology

In "Psychic Search" [April 1981] Stephan A. Schwartz refers to an alleged psychic, George McMullen, and presents the following evidence of McMullen's paranormal powers: "George had correctly sensed the presence of Africans in the Canadian Far West, which virtually rewrote a chapter of British Columbia's history."

I am a local historian and would love to know exactly which chapter of our history has been "rewritten" by McMullen's psychic perceptions. The history of black colonists in this province, and of European exploration on this coast, is quite well documented. This example of psychic archaeology remains unknown to local historical writers, unless a group of Africans had been teleported here by UFOs.

Ed Starkins
Vancouver, B.C., Canada

Read The Secret Vaults of Time, *by Stephan A. Schwartz, published by Grosset and Dunlap, 1978, for a more detailed account of how West African slaves were transported to British Columbia.* —Ed.

More on the MX

Norman Spinrad's Last Word [March 1981], concerning the MX missile, confirmed my opinion that few Americans care about the MX and that those who do are misinformed.

Spinrad asserts that "200 square miles of desert" will be affected by the MX. At least 100 to 200 times that area is involved. He also places the cost at $30 billion,

CONTINUED ON PAGE 101

DIALOGUE

FORUM

In which the readers, editors, and correspondents discuss topics arising out of Omni *and theories and speculation of general interest are brought forth. The views published are not necessarily those of the editors. Letters for publication should be mailed to* Omni *Forum, Omni Magazine, 909 Third Avenue, New York, NY 10022.*

Profit *and* Preservation

This is in response to the letter from Mr. Garrett A. Smith that appeared in Communications [April 1981] concerning our Riggatron fusion reactor's characteristics and our profit motivation.

Indeed, if environmental concerns render storage of "used" Riggatron units economically unattractive, it would be foolish to propose throwing them into "old mine shafts." In fact, all of our studies show a strong incentive to reprocess old units in order to extract the ^{60}Co transmuted into the copper materials by neutron irradiation during operation. This ^{60}Co can be separated at modest cost in reprocessing plants and can be sold quite profitably in markets for food sterilization/preservation (for nonrefrigerated LDCs) and for secondary sewage sludge irradiation (which makes low-cost cattle feed or fertilizer). Thus the by-product ^{60}Co can dispose of a normal garbage problem at a profit.

Finally, and more important, Riggatron tokamaks might be used to solve the nuclear-waste-disposal problem. This is possible by placing the wastes of fission reactors in a blanket around the fusion light bulb and then transmuting these wastes by neutron-capture chains to less noxious isotopes. Studies made in the past seven years by Bagatelle Northwest and others show that safety storage times for the most hazardous radioactive materials, cesium and strontium, could be reduced by a factor of ten, from 400 and 900 years, respectively, to 40 and 90 years, by one year of blanket irradiation. The much longer lived actinides could all be "burnt-up" within a few weeks in such a blanket. And, of course, all of this generates thermal energy as well, which can be used to make steam and electrical power, which can be sold at a profit.

In our society, profit is the fuel to run the engines of commercial development. The best kind of profit is that which derives from improving humankind's lot while preserving the home planet. Happily, Riggatron energy systems seem capable of both, with large profit margins.

Robert W. Bussard
President, INESCO
San Diego, Calif.

Science and Ethics

The article "Rent-a-Conscience" [May 1981] seems flawed in several respects.

First, its title implies that ethics, morality, or conscience can be called upon in crises, but is otherwise to be left on the shelf. In fact, science and ethics must cooperate with each other; otherwise one of them will seduce the other.

This seduction, secondly, could take the form of the Inquisition, but is the other alternative any better—absolutely unbridled scientific research and experimentation? Unless scientists take some ethical responsibility, the Moral Majority and their ilk will come on like gangbusters. But ethicians also need to assume some scientific responsibility.

And ethicians, in the form of church or religious leaders, are beginning to take technology seriously. In addition to Father [Richard] McCormick's work (mentioned in the article), the Pope John XXIII Center, in St. Louis, is educating Roman Catholic bishops in such matters as birth and death technology and human sexuality.

I compliment Mr. Colligan for an otherwise fine article, and *Omni* for its refreshingly optimistic tone about science and technology. Also for its ethical concerns, as shown in "Rent-a-Conscience" and in the publication of the continuing debate over the use of fetal brain material for transplants.

Rev. Theodore Seneschal, O.S.B.
St. Gregory's College
Shawnee, Okla.

Vortex Vituperative

I'm writing in response to the article "Magic Man" [May 1981]. The portion of the article that discusses Scot Morris's experiences at the Oregon Vortex is interesting writing, but in reality there are as many weaknesses in Mr. Morris's article as he says there are at the vortex. His "experts" are in fact professional debunkers. As such, they cannot be considered scientists, nor can their methodology be considered valid to assess what they say they are studying. Mr. Morris takes Ray Hyman at his word on these matters; I just don't think that's good enough.

I have a doctorate from the University of Michigan in behavior and environment; I have taught at four universities; I am a former associate editor of the *Journal of Environment and Behavior*, have published two college texts in environmental education and psychology, and have published several articles in professional journals. Some six years ago, while teaching at the University of Oregon, I began to study the vortex phenomenon. I have now visited four vortex areas: the Oregon Vortex, the Santa Cruz Vortex, and two in the Black Hills of South Dakota. I have studied the sacred places of American Indians, Eskimos, and other cultures, seeking verification of claims that these areas are "special." The vortices appear to be localized anomalies, with fields strong enough to influence animal behavior and plant growth.

Some of the things that the guide tells people at the Oregon Vortex cannot be substantiated. The vortex doesn't appear on charts that the Federal Aviation Administration maintains, but a strong anomaly exists nearby, which is listed. The geology of the area is quite peculiar: There are many deposits of various metals and other elements in igneous rock. The work of biometeorologist Professor Solco Wolle Tromp shows that localized anomalies are hardly uncommon. Tromp also shows convincing data about human perception of such anomalies. The phenomenon of magnetotropism (plant life being influenced by magnetic fields) is also well documented.

Perhaps most telling about the article is Mr. Morris's complete failure to explain the-

CONTINUED ON PAGE 116

LAKE MAKER

EARTH

By Don Wall

Hawk Hyde can always tell when the bald eagle is watching ducks on the lake. All the ducks move close together and form a cluster, a single mass, which confuses the eagle. But when a sick or crippled duck is separated from the rest of the flock, the eagle flies in swiftly and attacks it.

"He takes about a duck a day," says Hawk, whose real name is Dayton O. Hyde. Hawk is a man of fifty-six, craggy-faced and weather-beaten. "The eagle is the veterinarian of the lake. Maybe he doesn't ever think, 'Well, that's an unhealthy duck; I'd better kill it,' but the way he works fits nature's pattern."

The setting of this natural drama suits Hawk's own pattern, too. Five years ago the lake wasn't on his ranch, in southern Oregon. He and his sons bulldozed worthless flatland into a lake bottom and dammed off a canyon, using snow melted in the spring to supply water. When the lake is completely filled—it's about two thirds of the way now—it will have a shoreline of three and a half miles and a depth of 60 feet. This land once was so dry that in July and August there wasn't enough water for a Steller's jay to drink. Now, thousands of birds and other animals come in every day to bathe and quench their thirst.

"I created this lake out of nothing but sagebrush and snow water," Hyde recalls, sitting in a resurrected truck seat on the front porch, wind chimes tinkling in a soft breeze. "I just looked at my worst piece of land and wondered how I could turn it into a wildlife paradise."

Over 5,000 ducks live here, a pair of bald eagles, two pairs of sandhill cranes, hawks, owls, a family of trumpeter swans, coyotes, mountain lions, and a single loon. Hyde had expected that the osprey who live above the lake would feed upon the rainbow trout. But the trout are up to 12 pounds now, and that's too heavy for a bird with a five-foot wingspan.

Hawk Hyde thinks of his wild world as the bare bones of a man's dream. He lives at the lake in a small cabin he built with his own hands, and he writes about wildlife. In 1968 he published *Sandy: The True Story of the Sandhill Crane Who Joined Our Family*. His companions are an old yellow dog and an Alaskan wolf, which he bought from a trapper for the price of its pelt. Occasionally Hawk and the wolf howl together at four in the morning.

The Hyde ranch, Yamsi—which means "home of the north wind," in Klamath Indian—spreads over 6,000 acres of a forested mountain valley. If you look at a map of southern Oregon, you'll see that Chiloquin is adjacent to the Fremont National Forest. It's magnificent. Hawk owns an additional 6,000-acre tract in the vicinity and 1,500 head of cattle. Unlike many ranchers, Hyde never thinks of wildlife as his enemy.

"When our cows died in the winter, we would drag their bodies out into the woods and leave them," he says. "What we were actually adding, without knowing it, was supplementary feed for the coyotes during a time of stress. Instead of removing the coyotes we got along with them and we didn't suffer the losses that other ranchers in the area have."

As a rancher, Hawk understands that when a man goes out into his corral and a bunch of his sheep have been killed during the night by a coyote, it's pretty hard to turn him into a coyote lover. But Hawk objects to the view that mankind has dominion over wildlife.

"I hate the word *dominion* more than any other word in the English language," he says. "I've always been able to look out and see the energies of the world. I can hold my hand up to a tree and feel the energy. I can see it in the rocks—it's hard to explain. It's like seeing somebody's aura. I'm seeing the aura of the earth. I don't know. Maybe I've taken a little more trouble to communicate or to understand or to sit and look and think about these kinds of things."

Hawk believes that man and nature can coexist, that you can have your ranch and wildlife, too. He's putting that philosophy into practice.

His plan, the Wildlife Stronghold, would give the nation a natural preserve that all the federal money in the world couldn't produce. The Wildlife Stronghold calls for private agricultural land to be set aside for

CONTINUED ON PAGE 109

Hawk Hyde and his wolf: Humankind must fit nature's pattern, not the other way around.

CURE BARRIERS

LIFE

By Dr. Bernard Dixon

In a single day earlier this year, $20 million was wiped off the market value of a top British pharmaceutical house when safety problems forced the company to abandon work on an antiasthma drug. As the stakes grow higher daily, the risks dizzier, and the regulations more intense, a troubling question emerges: How can any firm afford to pursue treatments for infinitely rarer disorders?

The problem is illustrated by an ailment so infrequent, its name does not even appear in many popular medical guides: Wilson's disease. This inherited condition results from a simple error in body chemistry. Copper accumulates in the liver, brain, and other organs, thwarting their normal functions and ultimately killing the patient.

At one time no treatment whatever was available. Victims suffered increasing brain damage, which interfered with speech and movement until death relieved them of their disabling torments. Then the picture changed dramatically with the discovery of chelating agents, substances that combine readily with metals. Chemists used the agents in experiments, but they were also found useful in "mopping up" the excess metals that accumulate in patients suffering from Wilson's disease and lead poisoning.

One particular chelating agent—penicillamine—proved highly effective in ridding tissues of toxic metals. It binds copper and lead tightly and is then excreted, expelling the poisonous elements. Thus a derivative of one miracle drug, penicillin, wrought another miracle—this time benefiting people stricken by Wilson's disease.

So far, our tale is one of serendipity: Tactics for defeating a lethal disease emerged from quite unconnected research. The result was a drug (now marketed by Merck, Sharp and Dohme) with total power to prevent the ravages of this rare malady. But that is not the end of the story. A few patients developed side effects so hazardous that penicillamine had to be withheld. How could any pharmaceutical firm be expected to commit precious resources in searching for a substitute drug to treat a minority of patients out of an already tiny minority of the population?

One man, Dr. John Walshe at Addenbrooke's Hospital, Cambridge, tackled the problem vigorously. He experimented with alternative chelating agents and came up with the equally effective Trien, which, unlike penicillamine, had no toxic side effects. A friendly pharmaceutical firm did a few tests with Trien, but they declined Walshe's invitation to produce regular supplies. He was equally unsuccessful in approaches to other manufacturers. The market for such a drug was too tiny to justify a profit-oriented program.

With no other recourse, Dr. Walshe began synthesizing Trien on a laboratory bench at his hospital. As Britain's sole supplier of the lifesaving compound, he worries about the future. What will happen to his patients when he retires or dies? And even if someone else can continue supplying them, will Britain's regulatory authorities then insist on the drug's being properly tested and approved? For the moment, those obligations have been relaxed in this one special case.

The saga of Trien highlights a broader problem. The president of Janssen Pharmaceuticals, Dr. Paul Janssen, recently pointed out the Catch-22 his company faced in devising a therapy for mucocutaneous candidiasis. Because there are only about 400 cases of this terrible infection in the entire United States, the disease would be eradicated before licensing conditions could be satisfied! Citing 50 similar uncommon conditions, Dr. Janssen said it would be pointless to embark on the process of meeting statutory regulations. Why bother? After all, drug companies are not charities.

But we cannot find the answer in monolithic state ownership, either. Nothing of novelty and value—nothing—has ever emerged from the pharmaceutical laboratories of the Eastern bloc. The solution, surely, is in incentives and a more flexible approach to drug licensing. Medicine for rare diseases is a topic that needs urgent attention from governments on both sides of the Atlantic.

Dr. Walshe: Britain's sole supplier of a lifesaving compound for victims of Wilson's disease.

JOURNEY TO THE GIANTS

SPACE

By Charles Kohlhase

It weighs almost a ton and measures approximately four meters by four meters. Its two television cameras take tens of thousands of pictures of worlds in the outer solar system. A collision with a micrometeoroid could cause it to lose its orientation temporarily, but it wouldn't founder. It is made of millions of parts. If certain components fail, others will take over. We're talking about the fantastic *Voyager 2*, the semi-intelligent robot that, for nearly four years, has explored unknown worlds.

What enables *Voyager 2* to sail so blithely through space? Consider this law of physics: An object in motion will keep moving unless an outside force acts on it. And, of course, there is no air resistance in space to slow *Voyager 2* down. Gravity assist alone controls the robot's velocity, that is, its speed and direction. When *Voyager 2* swings around a planet's trailing side—the side away from the planet's direction of motion—the planet's gravity considerably increases the spacecraft's speed with respect to the sun and changes the craft's direction of motion. Fortunately, space-exploration technology at the time of the *Voyager 2* launch had progressed far enough for scientists to exploit the alignment of the four outer planets; this event will not recur until the twenty-second century.

Boosted by Jupiter's enormous gravity, *Voyager 1* sent home more new knowledge last November about Saturn than we've gained since man first pointed a telescope toward the heavens. One of the most startling discoveries was the superb complexity of Saturn's ring system. This month we prepare for a second flood of knowledge—*Voyager 2*'s follow-up encounter with Saturn.

The first *Voyager* raised many bewildering questions about Saturn's vast swarm of orbiting ring particles and clumps. For example, the mysteriously braided F ring will be more closely scrutinized by *Voyager 2* to determine whether the ring is interwoven three-dimensionally. If it is, that will explain more about the motion of its particles. Why the F ring is braided is unclear; as far as we know, it is the only ring of this type in our solar system. Or is it? *Voyager 2* will scan Saturn's rings with much greater detail and listen for the powerful megawatt-current discharges between the icebergs that nudge one another during their endless, crowded merry-go-round about Saturn.

Since *Voyager 2* will fly closer to some of the Saturnian moons than *Voyager 1* did, we expect to receive more details, perhaps even some revelations, about these curios in the outer solar system. The proximity of *Voyager 2* to these moons will enable planetary scientists to examine smaller surface features.

One moon that perplexes scientists is Iapetus. The front half of Iapetus, which faces the direction it travels in, is six times darker than the half facing the opposite direction. Will *Voyager 2* disclose astonishing new facts about Iapetus's leading or trailing hemispheres? Another puzzling misfit in Saturn's flock of icy satellites is Enceladus. *Voyager 2* may tell us why Enceladus's surface seems to show almost no impact craters.

Voyager 2 will not fly as close to Titan, Saturn's largest moon, as *Voyager 1* did, because of the flight-corridor choice to continue to Uranus. Also, we have discovered that Titan is covered with a thick haze, which cannot be penetrated by *Voyager*'s cameras. Hereafter, in order to capture an accurate portrayal of its surface, spacecraft may use synthetic aperture radar to pierce Titan's dense atmosphere.

Other key satellite encounters include Mimas, Tethys, Dione, Rhea, and Hyperion. *Voyager 2* will look for revealing surface marks on these moons, which will give Earth-based scientists a better idea of how such moons are formed. *Voyager* will also enable scientists to measure the dimensions of craters and faults. Every day this month, *Voyager 2* will send about 400 pictures back to Earth, making scientists work overtime to explain the evolution and composition of these baffling moons.

Voyager 2, whose closest encounter with Saturn will occur on August 25, at 11:24 P.M. Eastern daylight time, will be

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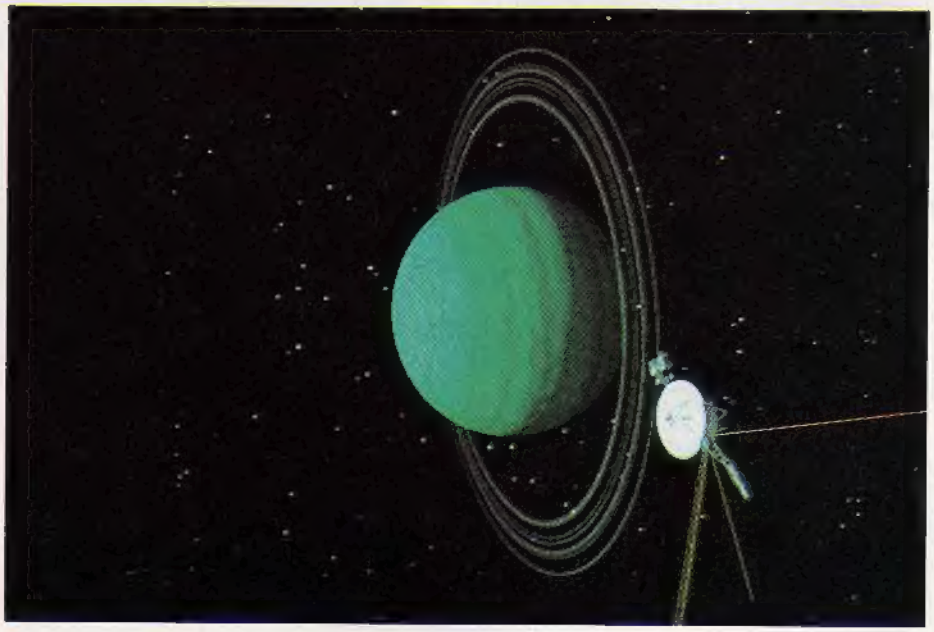

Computer graphics simulate Voyager 2 *shortly before its encounter with Uranus in 1986.*

DREAM CONCEPTIONS

MIND

By Chris Tucker

For centuries, since long before Freud charted the hidden territory of the unconscious, dreams have been thought to hold deep meaning. From soothsayers to psychiatrists, experts have tried to fathom the message of Morpheus. But if Harvard psychiatry professor Allan Hobson has his way, we may have to abandon our cherished belief in dreams as the road to the unconscious. Dr. Hobson and his associate Dr. Robert McCarley, codirectors of the neurophysiology lab at the Massachusetts Mental Health Center, in Boston, have mounted a strong challenge to the Freud-inspired notion that we can discover our secret motives and desires through dreams.

According to Hobson, bizarre dream events can be explained without recourse to the Freudian view of dreaming. "We have a completely different way of viewing the bizarre nature of dreams," says Hobson, who has worked in sleep and dream research since 1960. Hobson maintains that all dream events are part of the brain's normal physiological functioning. "We say that scenes shift and people meld into one another because of the way the brain operates during sleep.

"The brain is programmed in its own way to produce REM (rapid eye movement) sleep every ninety minutes during the sleep cycle," Hobson explains. "Dreaming is the psychological concomitant of an essentially physical process. Ideas have nothing to do with it."

It's quite normal for our dreams to seem strange and incomplete, Hobson says, because during sleep our brains are forced to make the best of a bad situation. "You get a number of low-level signals sent to your brain, which doesn't know whether it's awake or asleep. With no outside information to help it, the brain starts trying to make sense of the situation."

This mechanistic interpretation highlights Hobson's departure from the Freudians. He believes, for example, that distressing feedback from our sleeping bodies, not some taboo desire, gives rise to our dreams of struggle and flight. In REM sleep our bodies become rigid. Obviously, being unable to move is unpleasant. Without information obtained while conscious, the brain does not realize that the paralysis is normal. Thus, if we try hard to move our legs but cannot, the brain may incorrectly conclude that we are running from an unknown menace.

Hobson and McCarley base their dream model on the philosopher's tool known as Occam's razor: When two explanations of a phenomenon are available, one complex and the other simple, prefer the simple. Hobson believes his symptom is simpler than Freud's, requiring fewer risky assumptions. He doubts that nature would provide man with "an important self-communication system," like dreaming, that required outside help (at $50 per therapy session) to comprehend.

Using the razor, Hobson slashes away at another hallowed Freudian concept, information degradation. For the Freudians, dreaming begins with an unconscious idea—say, of sexual desire. Since the idea in its original form cannot slip by the watchful censor of the ego, the desire may manifest itself in the dream as flying, riding a horse, walking down stairs, or another symbolic activity.

Hobson vigorously dissents. "We're saying just the opposite. Dreams don't start with ideas, but with perceptual chunks. 'It's red. It's over there. It moved.' Then the brain tries to build a coherent picture out of the chunks, which may have no underlying relation to one another. That's why the final image is like a surrealist picture."

Though aware that their model needs more experimental testing, Hobson and McCarley believe that their efforts will have liberating effects. "We're ready to ask questions about dreaming that have not previously occurred to people," Hobson claims. For example, McCarley wants to probe the connection between the REMs that accompany dreams and the fact that the visual sense dominates in most of our dreams. Why do touch, taste, and smell play so little part in human dreams? Hobson hopes to rid the public of the lingering fear that dreams are primarily a defense mechanism that is vaguely unhealthy. "Our view is that dreams are normal—and normally bizarre." ∞

C. Verlinde's painting depicts the surrealistic visions our minds conceive while dreaming.

FILM

THE ARTS

By Jeff Rovin

Cornered, as rarely he can be, intergalactic rogue Han Solo offers a grudging portrait of the actor who portrayed him in *Star Wars*, *The Empire Strikes Back*, and the upcoming *Revenge of the Jedi*. "Harrison? He'd rather be an actor than a star. I can handle that, though I wish he had a working knowledge of science fiction. He wasn't sure it was even possible to make a movie out of the stuff Lucas wrote, and it was torture explaining the mechanical and space things to him." Solo downs the last of his coffee. "Still, he did all right considering they cast him less than a month before *Star Wars* started shooting. The guy really applies himself."

Smiling boyishly, Harrison Ford sips from character and refills his coffee cup. "I don't mean to be operatic, but promoting myself to the public fills me with dread. Actors are just people who've caused a whole bunch of *other* people to show up in a crowded room and turn over their rapt attention, an actor's sole responsibility is to be *real* sure there's something worthwhile to offer that audience. The rest of it, our culture's interest in actors' personal lives and opinions, is just mythicalization and bullshit."

Ford has been a hero to millions of moviegoers since the premiere of *Star Wars* in 1977, yet he is the least visible figure in the Star Wars company. He will not accept any credit for the film's success ("It was George's picture") and refuses to abandon his serious, protean career to pursue the huckstering TV-talk-show circuit or play a succession of Han Solo parts. "I might make more money," he grants, "but it wouldn't be long before I'd be bored and stereotyped."

The breadth of Ford's talent is a revelation to those who know him only as Chewbacca's pilot. Roles such as the raucous, hardheaded outlaw in *The Frisco Kid* and the introspective, soft-hearted pilot in *Hanover Street* quickly dispel visions of the cocky space mercenary; this is especially true of Ford's latest and most textured performance, as Indiana Jones in *Raiders of the Lost Ark*.

Jones is the hero of this stunning fantasy-adventure film, inspired by the

Harrison Ford in Raiders *an average guy caught up in swashbuckling circumstances*

likes of old pulp magazines such as *Doc Savage* and *G-8 and His Battle Aces*. The action occurs just before World War II, as the United States and Germany race to locate a religious relic rumored to contain the explosive power of creation itself. Jones is caught up in this quest, chasing clues from exotic bazaars to ominous temples, globehopping all the while from South America to Nepal to Cairo and elsewhere.

"Jones really is quite different from the other characters I've played." Ford explains. "He's a scholarly man, a professor of archaeology and an expert on the occult. Otherwise he's just an average guy who finds himself in swashbuckling circumstances and rises to the occasion. Also unlike Solo or, say, the soldier I played in *Force Ten from Navarone*, Jones is the person this film is *about*. So there is necessarily more time given to developing his character."

Traditionally, the scope that gives epic movies much of their flavor has also tended to make them two-dimensional. Not so with *Raiders of the Lost Ark*, and Ford explains why. "It's true that events in big movies like this one or the Star Wars series are usually so extraordinary that the characters needn't be. This seems to be a problem with the few science-fiction films I've seen, where outer space or a city of the future or a monster like the Creature from the Black Lagoon overshadows everything else. But there are ways of overcoming this, the most obvious being to have a strong story beneath the layers of sets and special effects. And in that scenario relationships are damned interesting, even if they're not on the screen for as long as you'd like.

"Then there's the way you play a part in a fantastic setting. I've found that no matter what the script says, you don't obligate yourself with intellectual marching orders until you root around that unfamiliar country or planet or spaceship, at the same time watching to see how the other actors relate to it. Once you're in the situation, you may find that a line that read very dramatically in your living room sounds real tame spoken inside an

asteroid When I flow with that strange new environment the unwritten depth that rounds out a character just seeps to the surface And when that happens all I need to do is get dressed and have someone show me where to stand"

Ford notes that most of the research he does while preparing for a part actually involves studying atmosphere rather than character In the case of *Raiders of the Lost Ark* he read every archaeological book he could find from the 1930s *Star Wars* was somewhat simpler "All he did was wear his costume under his street clothes and practice self deprecating one-liners

Ford insists that he could have been happy in a number of professions However acting is the career he has most wanted ever since his college days in Chicago Nevertheless he almost gave up on the profession less than a decade ago "My life was pretty well directed until I left college to go into summer stock then left *that* to go to Hollywood When I'd been there for six months Columbia Pictures put me under contract for seven years at one hundred fifty dollars per week with all the respect that that implies The relationship didn't last very long I spent the next eighteen months or so at Universal as a contract player then freelanced around in the mid-Sixties This was all pretty discouraging So I dropped out and became a carpenter I guess I did still be building furniture if I hadn't fallen in with George Lucas

Raiders of the Lost Ark marks the fourth film Ford and Lucas have made together though Lucas's role was that of coexecutive producer The movie was directed by another *Wunderkind* Steven Spielberg whose *Jaws* and *Close Encounters of the Third Kind* are not far behind the Star Wars films as the most popular pictures in cinema history And not since *Star Wars* has such a media fuss been made over a motion picture

Anyone who watches the sprawling $20 million *Raiders of the Lost Ark* will appreciate Ford's description of it as "a lot of movie to make" This factor compounded by a tight shooting schedule made Spielberg work his actors hard Ford credits much of the film's success to that intensity "I like working with people who are never at a loss for ideas Steven is like a Chinese menu where you always end up with more than you can eat That's my idea of creative freedom where you're not cooped up inside yourself and can collaborate with talented people"

However Ford concedes that working for Spielberg was quite a different experience from being directed by Lucas in *American Graffiti* and *Star Wars*

"I very much admire them both What I find most admirable about George is his conceptual skill and his incredible nerve He somehow gets away with putting his visions on film at the same time proving that it was just the thing needed to revitalize the marketplace George also has great skill as a filmmaker Working with him is always terrific fun and a good exercise of the acting mechanisms

"As for Spielberg I plugged right into him He's a more willful kind of guy and we did a lot of arguing but I think we both enjoyed that At least we both benefited from it

Despite a cautious tendency to talk only about work Ford shows himself to be a watchful and pensive man His conversation reflects an attitude that might best be described as qualified nihilism If pressed he will admit that his most optimistic forecast for future society is one of attenuated decline

"I guess I worry about society almost neurotically though I don't do anything practical like stocking my basement with emergency provisions Civilizations at a point where our concern seems to be how *less* to harm people than how to make them any better and I find that fairly depressing The various processes of culture can improve the situation by inspiring people but it's the individual's responsibility to take it from there which just don't see happening a lot It wouldn't help for me to become some kind of martyr pleading to a crowd to avoid this cause or embrace that one, actors who get up and do that and fans who expect it are really misinterpreting a performer's job We're in another branch of public service we're assistant storytellers not role models or pontiffs of morality and logic I genuinely believe in that old saw about experience being the best teacher An actor's task apart from entertaining or diverting an audience is to offer those various experiences to educate people by his example

Ford contends that what movies should do ideally is give subtle direction to people's attitudes by exercising their emotions in concert with good intentions "There *are* movies that preach and in the hands of a director who's a poet of the system some of these films can change the way a person thinks But the audience for movies like this is historically very limited He points to *Star Wars* as an example of more broadbased functional filmmaking "Sure it's escapism but I think that when people who have seen the film watch a real space shot on television, they make a subconscious correlation They recognize that we human beings had better control our insane ambitions before we thrust ourselves onto new worlds fouling places besides Earth I'm convinced that movies do this best by focusing the audience's attention on the work rather than on a distracting style or idolatry of the actors

While Ford frets about the plight of generations to-be he hasn't even a hazy plan for his own future

Apart from starring as a bounty hunter of tomorrow in the currently filming *Blade Runner* after which he'll offer his swan song to the Star Wars trilogy Ford acknowledges very few goals for his career Yet he does confess to one immutable and selfish desire "People can pigeonhole me as whatever they want as Han Solo or as Indiana Jones, that's fine for them What's important to *me* is that I'm never denied the opportunity to surprise an audience And if that ever happens" he pauses and shrugs "Well you'll see there's this table left unfinished about ten years ago"

A HISTORY OF THE WORLD PART ONE

The question hangs in the air like smog Why Mr Brooks did you commit yourself to making a movie about the history of the world? Why not something with *real* sweep like the history of the universe?

Hands folded on his desk Mel Brooks nods with slowly glumness That's a rhetorical question of course and also a very funny one He gestures slowly toward the office walls which are papered with posters from his films "But let's not forget who's the straight man and who's the Jewish comic Now" he says refolding his hands "ask me a serious question before I bang your head on the desk"

A serious query is hastily tendered and the fifty-five year old Brooks smiles like a proud papa There *that's* a good question something insightful He sits back "Unfortunately I'm answering it in an interview in another magazine So you're out of luck

Brooks calls it "Jewish fencing" defending onesself with humor, in his hands it's a skill that's rapier sharp After just a few minutes with the Brooklyn-born comedian one realizes that he's more than just a funnyman he's a comic computer He consumes information and, instinctively isolating its foible or weakness thrusts it back as a joke Though Brooks has practiced his craft in virtually every

CONTINUED ON PAGE 112

Mel Brooks' Bad Jokes will never die

COLUMBIA PICTURES PRESENTS AN IVAN REITMAN — LEONARD MOGEL PRODUCTION

HEAVY METAL

PRODUCTION DESIGN BY MICHAEL GROSS MUSIC BY ELMER BERNSTEIN EXECUTIVE PRODUCER LEONARD MOGEL SCREENPLAY BY DAN GOLDBERG & LEN BLUM

BASED ON ORIGINAL ART AND STORIES BY RICHARD CORBEN, ANGUS McKIE DAN O'BANNON, THOMAS WARKENTIN AND BERNI WRIGHTSON

DOLBY STEREO DIRECTED BY GERALD POTTERTON PRODUCED BY IVAN REITMAN

Original soundtrack album on Full Moon Asylum Records

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COMING IN AUGUST

TELEVISION

THE ARTS

When *Omni* was launched in October of 1978, its publication revolutionized the magazine industry. Its immediate success demonstrated that science could be read in the American household that technology and the future were no longer the realm only of laboratory researchers.

In September *Omni* will come to primetime television. Its impact will be no less revolutionary.

"Existing science series are documentary shows that deal with images of today. We want our show to convey the awe and entertainment that are a part of tomorrow," says Bob Guccione, editor and publisher of *Omni* magazine.

In a television world where situation comedies, soap operas, and game shows reign supreme, *Omni* will hold a distinct advantage. Like the magazine, the show will transcend the banality and global problems of our own immediate world to present an inspiring, realistic vision of our future lives. "Mothers and fathers will *want* their children to watch the show and will want to watch it themselves," says Kathy Keeton, president of *Omni*. The show will reveal how science is changing our world in incredible ways, providing our only solutions to food, energy, and medicine problems. It will be a show that will extend the technological vision begun by Edison and Ford, Keeton says.

To create a television series of this magnitude, one that would successfully translate the magazine to the medium of film, has been no small task. But Guccione originally conceived *Omni* magazine with the intention of bringing it to television.

An exhaustive search for the most talented visually attuned minds in America has resulted in hiring award-winning producers Vivian Moss and John Savage. Their direction of *The Body Human*, aired on CBS in 1978, led not only to national recognition for the show but to an Emmy as well.

"We're trying to interpret in film," Moss says, "the look of the magazine. It's beautiful and somewhat surreal."

To do this, Savage adds, "We use a lot of special lenses. For a story dealing with interactive television, a Volti lens will capture images in a 360-degree field of vision. (The image comes out looking like a doughnut.) A snorkel lens will provide an inside perspective on how a Venus's flytrap digests its prey."

The need for a visually spectacular set design resulted in Guccione's looking abroad. In Rome, he met with Danilo Donati, winner of three Academy awards for his set designs of such films as Federico Fellini's *Satyricon* and Franco Zeffirelli's *Romeo and Juliet*.

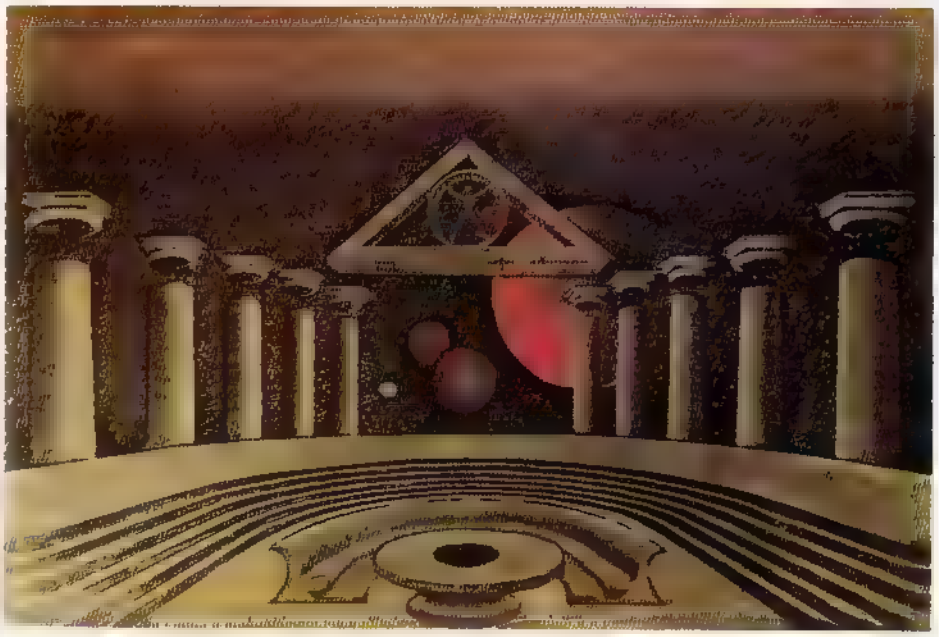
The Omni set is no less impressive. It is a magnificent image of a surrealistic Parthenon, whose distended columns appear to float freely in space. The set, Moss and Savage say, will serve as a bridge between the rigors of deep space, and the intimacies of molecular genetics.

The format of the half-hour show calls for a larger segment of roughly ten minutes, along with two shorter pieces. Peppered throughout will be visual "bumpers"—bits of graphics, computer animation, shots of photographic phenomena, and brainteasers patterned after the Games section in the magazine.

Camera crews have traveled to locales as diverse as China, Japan, and Colorado to cover the stories that will shape our future world. The technological wonders of Chinese acupuncture and the emerging development of space industry will be just a few of the topics covered. A robot programmed to speak with the voice of Bob Guccione represents a major breakthrough in robot technology.

How has the television industry itself responded to the new Omni series? Industry sources report it to be the strongest selling syndicated series ever produced in the United States, with plans for its licensing to as many as 30 other countries. The cost for the development of the series has exceeded $3 million, about twice the budget of any preexisting series.

Come the fall season, Guccione says, more than 80 percent of Americans will be able to tune in to the Omni show. They will see within the confines of their own viewing rooms how their lives, and their children's, will be dramatically altered over the next few decades. ∞



Segments of the Omni TV show will be introduced from a set designed by Danilo Donati.

CONTINUUM

Edited by Dick Teresi

HACKER MENTALITY

That old image of the computer as the Great Dehumanizer is starting to fade. Little by little people are beginning to form very personal bonds with these intelligent machines.

A large toy company recently received a pile of fan mail about one of its teaching toys: a microprocessor with an eight-track-tape cartridge setup packed in the body of a plastic robot. One woman who originally didn't want her son to have the toy wrote apologize for nearly denying my son the opportunity to befriend [the robot] because of my prejudice.' She went on: 'I'm sure my son would rather have [the robot] help him with his schoolwork than have me help him.

People with more technological savvy have gone even further off the deep end. Physicist Robert Eisenstein, of Carnegie-Mellon University in Pittsburgh, sees a peculiar kind of attachment to the most basic computer, the pocket calculator, among the bright undergraduates who take his physics courses. It amazes him how panic-stricken they get when they leave their calculators behind or when batteries go dead in the middle of a test. They seem lost, he says, and feel they cannot function without this lollipop at their fingertips.'

If these small calculators may be seductive, the big ones — the megabrains — are devastating. Joseph Weizenbaum, professor of computer science at Massachusetts Institute of Technology, was the first to talk about the phenomenon of the "computer bum" or the compulsive programmer. The term includes anyone who has a mania about working with computers to the point where he or she withdraws from the world to the fluorescent lighted cloister of the on-campus computer center. Compulsive programmers may end up communicating with no one but the computer, taking a break now and then only to talk to other compulsives through the computer terminal.

Stanford University psychologist Philip Zimbardo knows the type. He calls them "computer addicts." He believes their closeness to the computer can start early on in schools where human teachers use electronic tutors as backups in the classroom. 'Fascination with the computer becomes an addiction,' Zimbardo says, 'and as with most addictions, the substance that gets abused is human relationships.'

Any college or university with a computer center has its share of computer jocks, or 'hackers.' They may find it easier to relate to a machine which is absolutely predictable, than to a person who isn't, suggests Charles Rose, chairman of computer engineering and science at Case Western Reserve University in Cleveland. In one case, Rose had to recommend counseling for a student who tried to escape family problems by spending most of his time with a machine.

Not all of us have trouble at home. Why are we getting so close to these machines? Psychologist Zimbardo sees these electronic friendships as indicators of a greater social trend. More and more people, he says, have a kind of hacker mentality, putting machines — putting anything — before the needs of other people. More basic than the hacker mentality is the special allure of the computer. As one computer science graduate student put it, "They're very sexy, almost too fascinating. When you use them, you have to back off now and then." For the programmer, the lure is power. He is a creator of universes for which he alone is the lawgiver, explains MIT's Weizenbaum. 'No playwright, no stage director, no emperor, however powerful, has ever exercised such absolute authority.'

Right now, moving through our elementary and high schools, there are the children who could be called the computer generation. Having grown up with computers, they may be immune to their sex appeal, but they may adjust in their own way. Futurist Peter Schwartz, of the Stanford Research Institute in California, predicts that years of interacting with computers will actually change how these children think. They will, he believes, regard abstract concepts more palatable to a computer above the world of the concrete. A computer mind-set would also value logic skills and prefer man-made to natural or organic things. And since computers function in a realm where logic, order and predictability are the norm, they may also leave the computer generation unprepared to cope with the world outside computer circuits. He does not foresee such a neat, preplanned program.

If this happens, what will result? A generation ultimately disappointed and disillusioned by what the computer has taught them? As Eisenstein points out: 'There's a tendency for people to put blind faith in devices like that, and I think one of the reasons we're in trouble today is that we blindly trust in technology's ability to solve all our problems.' *DOUGLAS COLLIGAN*

CONTINUUM

MOVABLE MALLS

Retailers of the future will bring their stores to the customer, just as merchants did in the past, according to Elinor Selame, president of a design firm that has developed a mobile mall.

Describing the mobile malls as "retailing on wheels," a plug-in, hook-up, and sell concept that makes sense in an age when mobility, energy and time saving techniques have become number-one priorities, Selame believes moving stores will become common in the next ten years.

The prototype developed by Selame Design in Newton Lower Falls, Massachusetts, is a trailer that opens like an accordion. It operates hydraulically with the trailer unfolding laterally. A skylight will let in the light and if it weren't for cash registers it wouldn't need electricity at all in daylight, says Joseph Selame, the firm's design director. Today's shopping malls, he claims, are "granite mausoleums."

As people become more energy-conscious, the retailer will have to follow suit and go where the action is, Elinor Selame says. "It will be the age-old concept of the traveling merchant, but instead of using camels and sailing vessels, the future retailer will use superhighways." — Alan Maurer

CAT-FLAP BOMB

Cat fanciers and proponents of nuclear disarmament now have a way to serve both of their causes at the same time.

In the files of the English Patent Office is patent number 1 426 698, or "Photon push-pull radiation detector for use in chromatically selective cat flap control and 1 000 megatonne earth-orbital peacekeeping bomb," as it is officially known. According to the English publication *New Scientist*, the idea is the brainchild of a now deceased Patent Office employee who was looking for a way to feed his aging cat and by a flash of insight also felt he stumbled onto the ultimate nuclear warfare deterrent.

Black cat inspired invention

The idea came after the inventor kept seeing his old ginger colored cat "overtaken on the way to his cat food by the black cat from next door which is much younger and more agile."

His solution was a special light sensitive switch that opens the cat flap in the door for a ginger cat but not for a black one. As a cat approaches the flap, its weight triggers the switch which flicks on two lights. A photoelectric cell measures how much light is bounced off the animal and it will open the flap only if a great deal of light is reflected — as from a light colored cat.

In a related patent for an ARNDS (Automatic Response Nuclear Deterrent System) the same inventor said the cat flap switch might be hooked up to a 1 000-megaton bomb put in orbit around the earth. When it senses the light given off by a nuclear missile launch from any country, the orbiting gadget would, instead of opening a cat flap, drop the bomb on the country.

In defense of his 1,000 megaton cat flap, the inventor said: "If all your nuclear energy were used for peaceful purposes, instead of a large part of it being stored for blowing each other to bits with H-bombs and the like, you could save a hell of a lot of money, which would help to stop world inflation and the added might even bring down the cost of tinned cat food." — Douglas Colligan

Itinerant merchants invented movable stores centuries ago. Now the idea is being applied to entire shopping malls.

FAST FITNESS

A healthy young adult can improve his strength up to 30 percent and his stamina up to 25 percent in only two weeks training just 20 minutes a day. If he has group support, he doesn't even need self-motivation.

Working with 50 students and a formal physical fitness program often standard exercises (chin ups, push-ups, etc.), Dr. John Pearn of Brisbane, Australia set out to answer a question invariably asked of doctors recommending exercise: "How long before I'll be in good shape?"

After just 14 days the 50 students (30 were eager to get fit, but 20 were enlisted as controls precisely be-

cause they were poorly moti vated) improved dramat ca y They were ab e to complete the ten-course program far more rap dly, in dicat ng greater muscle strength And despite exertion their hearts weren t beat ng nearly as fast nd cating they had greater card opul monary endurance or stamina

Reporting in the *British Medical Journal* Dr Pearn found that h s contro group experienced the same m provement as the h gh y mot vated group In the absence of des re Pearn says, peer support s crucial — as are a carefully thought out regimen and mmediate feedback confirming that progress s being made

Norbert Lempert

LEFT-HANDED SUGAR

It's everything sugar isn't and saccharin shou d be It's someth ng called L- (for eft-handed) sugar, the heart of a sweeten ng process re-cently patented by B o spher cs, nc of Rockv e Maryland

Very s mply explains Dr Gi bert Levin who devel oped the process L sugar is a substance w th the same chemical components as the sugar you spoon nto coffee or over cereal (right handed sugar) but its mo ecu ar arrangement is the m rror im-age of ordinary sugar s

You get most of the advan-tages of sugar — the sweet taste and no aftertaste and none of the d sadvantages Because our digest ve en zymes have evolved to ab-sorb only right-handed sugar, L sugar passes through the human d gestive tract w thout be ng ab-sorbed making it non-ca oric. Since bacter a con sider it to be a nonfood as we l it does not contr.bute to tooth decay.

Dr Levin says the whole not on of m rror image left handed mo ecu ar structures of substances goes back to the days of Louis Pasteur Levin gave the idea some thought while design ng fe detecting experiments em-ployed by the *Viking* lander on Mars

As he mu led over some down to earth app cations Lev n hit upon L-sugar "You m ght say the idea came to me out of left field, he notes with a chuck e

Biospherics' L-sugar has a ready passed ts taste test One panel of testers could not tel the left handed ver s on from the r.ght-handed

The challenges remaining now Levin says, are to get the Food and Drug Adminis-tration s approva for the sugar and to devise a cheap way to synthesize it The cur rent opt ons include build ng it from chemical com-ponents find ng a naturally occurring source of L-sugar or produc ng it by genet c eng neering Right now there is an enormous sugar mar-ket 85 pounds a year per person waiting

Douglas Co gan

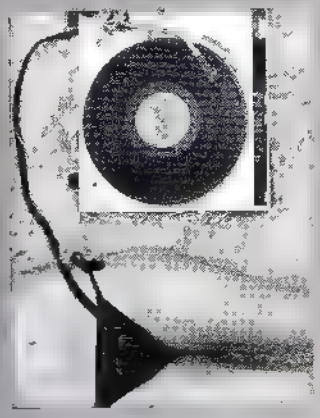
"Forever is a long time but not as long as it was yesterday

Dennis Hongniés

ROCK AND ROLL HOT PANTS

The latest discotechno-logical breakthrough is an item ca led Rock and Rol Hot Pants

By w ring your shorts or panties to a stereo speaker wi h a 15 foot cord which re-lays the mus c to a two-inch disc on your waistband you get an ncredible tingle all over your body" c a ms in-ventor David L oyd He got the idea for the stereo hot pants which come both n men s and in women s ver-

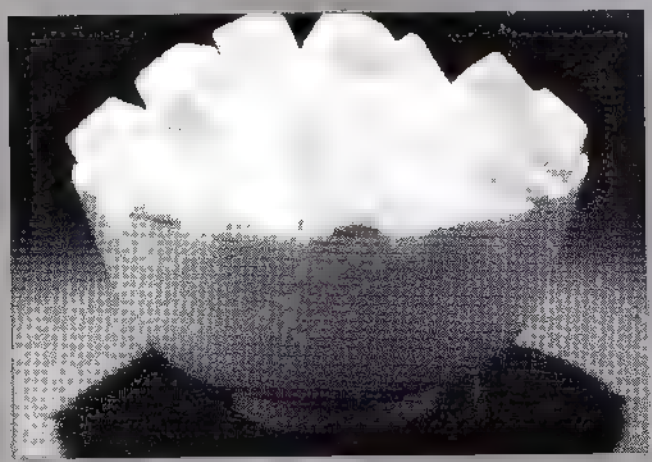


Hot pants "De doop de doop "

sions from an saac Newton ke incident Sitt ng under-neath a previous nvention, a stereo 'flying saucer that hangs from the ceil ng, L oyd jumped when it fe l in h s lap Then de doop, de doop doop doop I began to smi e,' Lloyd says 'It felt good I said, 'Wa t a second th nk I've just invented someth ng We worked on develop ng a real y pulsat ng speaker, and now it s going well "

For those who want a thrl, Lloyd recommends not rock but classica music "Try the *1812 Overture*, he says 'The cannons are something else

Allan Maurer



Conventional sugar is sweet and has no aftertaste Left handed sugar is sweet has no aftertaste and doesn t make you fat

"The real danger is not that computers will begin to think like men but that men will begin to think like computers."

-Sydney J Harris

CONTINUUM

PIESEL POWER

One day last summer Joel Curtis a researcher on a Gold Kist peanut farm in Oklahoma decided on a lark to put peanut oil in an old tractor It worked beautifully, as well as diesel fuel Curtis said We ran it around the yard for about an hour The emissions smelled like popcorn He dubbed the fuel piese

Curtis's brainchild joins a growing number of experimental fuels using vegetable oil to replace petroleum A key advantage is energy content While alcohol fuels

Peanuts Pleasant emissions

(methanol and ethanol) have only one half to two thirds the energy of petroleum vegetable oils approximate and sometimes even exceed the power content of petroleum fuel

Gold Kist is now blending a 30 percent soybean-oil mixture with diesel Joseph Cox Gold Kist's engineering director said that after the oil is extracted the protein meal is still left for food Other candidate oils being examined are cottonseed sunflower (which the Republic of South Africa is researching) linseed and coconut An Australian study says a typical farmer could satisfy all his diesel needs with a tenth of his acreage

The cost for vegetable oils today is $1 50 to $2 25 per gallon and petroleum prices are rising Some experts suggest recycling the millions of gallons of used cooking oil now discarded by homes schools restaurants and various other users of cooking oil

Of all major domestic crops however peanuts have the highest oil yield per acre says Joseph Peters, a University of Alabama engineer who works with Gold Kist But while large areas are available to grow more peanuts the U S government has limited the acreage to support peanut prices The Reagan Administration is considering removal of the limits however opening the way for a peanut answer to the oil cartel Could you imagine Curtis said "all those New York City buses smelling like popcorn?

Stuart Diamond

HUMAN POLLUTION FINDERS

The latest pollution-detection device is people

To learn exactly how much pollution people inhale in a typical day, scientists have enlisted human subjects to wear instruments that measure the noxious fumes entering their bodies The activities of special interest are cooking working in an office, walking along city streets traveling, and being in the presence of cigarette smokers

The problem has been that we have been using fixed monitoring stations but

Newest pollution detection device is worn like a camera

people are mobile says Richard Zeskind of Science Applications the California company conducting one such study for the federal government

The devices, worn by a few dozen volunteers, are battery operated weigh up to 700 grams and resemble small tape recorders Most instruments have a digital readout The human subjects log their daily activities which are matched with the instrument readings The devices are worn like cameras by day and put on bedside tables at night

Preliminary findings indicate that smokers double carbon monoxide exposures for everyone in a typical office or cafeteria that cooking with a gas range causes higher particulate exposure than driving behind a smoky diesel truck and that driving on congested roads gives people the highest overall pollution — Stuart Diamond

ANCIENT PSYCHEDELICS

Excavating a Cherokee Indian ceremonial site in South Carolina Dr Jeanne Rungquist found something she did not expect the skeletal remains of more than 10 000 toads

Dr Rungquist explains "You expect to find the remains of deer rabbits, even a frog or two but not a mostly eleven thousand toads Toads don't have enough meat on them to serve as food So went to the literature She discovered that Indians in New Mexico and the Caribbean snorted a chemical contained in dried toad skins bufotenine Although toxic which may explain why it never attained widespread use bufotenine is a potent hallucinogen capable of transporting a user to never-never and for hours

Rungquist who has degrees in anthropology and zoology, theorizes that the South Carolina Cherokees used the powerful drug in ceremonies just as Southwest American Indians used peyote Allan Maurer

Pollution is nothing but resources we're not harvesting

— R Buckminster Fuller

AEROGEL

It looks and shatters like glass but is 96 percent air and insulates like fiberglass It can be used in superefficient house windows green houses and covers for solar collectors and even as a replacement for the sensing chambers at the ends of nuclear-particle accelerators

It's called aerogel and is the product of William Schmitt a twenty-five year-old graduate student in chemical engineering at the University of Wisconsin Madison who developed the material in two years of working nights and weekends Schmitt considered using aerogel as a thermal insulator even though previous research had indicated that this type of material which starts as a gelatinous slurry of silica sand would be difficult and extremely hazardous to manufacture He has now brought aerogel to the point of commercial application however

To demonstrate its feasibility Schmitt has produced an aerogel window a thin core of nontoxic aerogel sheeted with conventional glass that he hopes will make Thermopane-type house windows obsolete since his window insulates 15 to 18 times more effectively than one sheet of glass does

Because aerogel has one peculiar and dramatic vulnerability it dissolves back into a little pile of white silica powder if it comes in contact with water) the window's edges must be securely sealed with epoxy

The Wisconsin Alumni Research Foundation whose successful patents have included those for vitamin D and for warfarin (both a widely used rat poison and a powerful human anticoagulant) is in charge of exploiting Schmitt's development for future applications

Tim Onosko

William Schmitt and a piece of aerogel It starts as a gelatinous slurry of silica sand and may make Thermopane obsolete

ANIMAL LOVE

The variety of sex in the animal kingdom is amazing Anything humans can imagine can be topped somewhere says Dr Robert Wallace zoologist behavioral ecology specialist and visiting professor at Florida State University

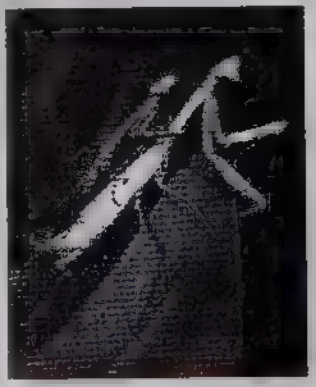
Author of the book *How They Do It* (William Morrow and Company) Dr Wallace cited some of the more bizarre animal mating habits The male praying mantis for example may find itself being eaten alive The female often pins her suitor to her thorax and begins devouring him eyes first She continues feasting destroying a clump of nerves beneath his throat that controls his sexual behavior Once these are gone so are all inhibitions and the headless insect frantically copulates thrusting with greater abandon than was possible while he was alive The female saves the plate that covers his sex organs for last

Other animals are just plain crass says Wallace Porcupines take golden showers (the male urinates on the female before intercourse) A lonely female porcupine will stimulate herself with a stick

Some beasts habits are strikingly human One kind of turtle presses her legs together if she doesn't wish to mate the poison frog conjugates only under a bed of leaves The female empid fly won't satisfy her lover until the male performs a nuptial dance for her with a silk he has spun

Homosexuality also flourishes Bedbugs store the sperm of their male friends in their bodies and later deposit it in a female geese form homosexual bonds and if a jealous female interrupts the pair a ménage a trois is born

Although Wallace expressed surprise at the limited number of animal-human parallels there is one trait common to both Organ size is not necessarily commensurate with the overall size of the animal Though an aroused whale sports a



Female mantis devours male

penis ten feet long three feet in circumference a full grown male gorilla can boast a penis barely two inches in length Snails have exceptionally long penises And the penis of a dolphin is versatile he uses this sensitive and flexible member to explore the ocean floor

Patrice Adcroft

Life is what happens to you while you're busy making other plans

John Lennon

CONTINUUM

BLANKET PROTECTION

Taking a five- to ten-minute walk through a blazing fire sounds like a daredevil circus act. But now a new gel-soaked blanket enables people trapped by fire to make it to safety because they are protected from skin-scorching flames.

Unlike a fireman's protective suit, the blanket—called the Water-Jel—can be deployed in seconds by simply opening it and lifting it out of a canister. Lieutenant Colonel Carmel Arkangel, MD, chief of emergency services at Fort Bragg's Army Hospital, in North Carolina, has been testing the blanket for use in the armed services.

Dr. Arkangel says, "Guys trapped in the cockpit of a burning plane could easily slip Water-Jel blankets over themselves and escape to a clear spot for donning their parachutes."

The milky-white gel that saturates the blanket contains ant bacteria iodine povidone and consists mostly of cooling oils derived from plants of the *Eucalyptus* genus. The blanket itself is made of 100 percent wool, woven in fishnet so that it can absorb and hold 13 times its weight. Manufacturer Jerry Truing says that wool is the least irritative material to use and, unlike synthetics, it doesn't release toxic gases.

Once exposed to heat, the gel solidifies slightly and turns the outside of the blanket into a protective cover. On the inside, the gel cools the skin and reduces evaporation and loss of body fluids, which can cause shock and death.

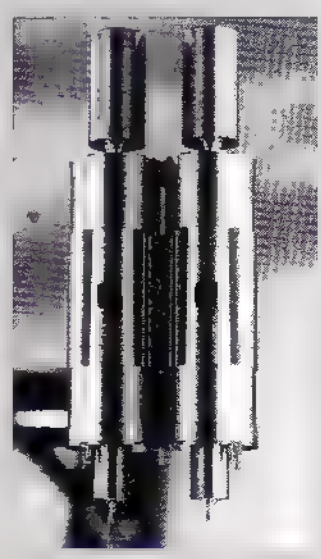
Not available yet to the public, the blankets are sold to fire departments, the armed services, and restaurants for about $200 by Truing Resources in Hartsdale, New York. Caroline Rob

Demonstration of gloves made of Water-Jel. The milky-white gel saturating the wool solidifies slightly to form a protective barrier

SOUNDS OF FAILURE

With a sudden groan of metal, a bridge collapses, killing a dozen people. A coal mine caves in. An avalanche rumbles down a mountain. A pipe breaks in a power plant. A dam fails.

These events have two



New acoustic device detects the faint cries of stress

things in common. First, they are often catastrophic. Second, they happen after a usually undetected weakening process that has occurred over days, months or perhaps years.

Advanced acoustic equipment now promises to detect this weakening process, saving tens of thousands of lives. By placing ultrasensitive detectors in areas of probable stress, scientists say they will be able to hear the faint cry of a crack growing in a bridge girder, beams weakening in a building, stresses on construction scaffolding or nuclear reactor vessels, and perhaps underground forces that presage an earthquake.

The principle here is that things don't fail all at once—warnings can be detected," says Donald Eitzen, director of acoustics research at the National Bureau of Standards (NBS). "Bridge failures are caused by stress cracks that grow over a long period of time and get long enough so the propagation occurs very fast and a catastrophe then ensues."

NBS recently invented a device that measures stress movement of less than a trillionth of a meter. It is also developing a hand-held monitor to check the degradation of everyday materials. Stuart Diamond

Sometimes men come by the name of genius in the same way an insect comes by the name of centipede—not because it has one hundred feet, but because most people can't count above fourteen.

George C. Lichtenberg

Thought is only a flash between two long nights, but this flash is everything.

Jules Henri Poincaré

HUNGER CUES

You're not particularly hungry. Then someone in the room starts eating a juicy steak or hot popcorn or banana cream pie. Suddenly you feel hunger pangs.

Is it all psychological? Not always, says Yale University psychologist Judith Rodin

who just finished a study on what makes people eat. Dr. Rodin found that some people secrete insulin when they see or smell food. The insulin causes a hormonal imbalance that makes them hungry, and food restores the balance. Those prone to this response are people

Get fat from just looking at food? A preposterous claim, perhaps, but research has found there may be a hormonal connection.

who generally react strongly — and physiologically — to their surroundings. "They are people more easily aroused by sad stories and funny pictures," she says. "They are more distractable when lots of things are going on."

The study, funded by the National Science Foundation, involved a review of animal data and experiments with human subjects. Rodin asked people who had not eaten in 18 hours to visit her laboratory, and while blood was being drawn, steaks were put in front of the subjects. The steaks were grilling and crackling in the frying pan to provide rich visual, auditory and olfactory food cues. Result: Blood insulin levels increased, and the subjects got very hungry.

The research supports earlier findings that overweight people have higher base insulin levels than thinner people. And insulin, besides enhancing appetite, also promotes increased storage of nutrients as fat. But Rodin also found that not all fat people excrete insulin at the sight and smell of food. And thin people may excrete insulin, eat, and not get fat. Obesity, she concluded, stems from many factors, including genes and metabolism. But her study does show that people aroused by sad stories should not even look at food while dieting.

Stuart Diamond

MOTHERLY FROGS

One way to tell a mammal from an amphibian — your grade school biology text may have taught you — is that mammal mothers nurture their offspring meticulously and amphibians don't.

Now the Costa Rican poison-dart frog — so-called because local Indians used to make lethal arrows from its skin secretions — has confounded things. According to German zoologist Peter Weygoldt, the female frogs not only try to ensure their tadpoles' safety, but they also painstakingly feed them one at a time.

Here is how poison-dart-frog mothering works. The mother carries each newly hatched tadpole on her back and deposits it in a carefully chosen spot — a puddle at the base of certain plants. Later she drops by regularly with food (unfertilized eggs) for each separately ensconced tadpole. The tadpoles communicate their whereabouts to Mom by making ripples in the water with their tails.

Poison dart frog. More maternal than the average frog.

This is the most elaborate maternal-tadpole behavior ever seen in a frog — comments tadpole expert Richard Wassersug of the University of Chicago. "It is the nearest observed thing to the complex maternal behavior of mammals and birds." — Lisa Levinson

REASONABLE CHIMP

Sarah is a 16-year-old chimpanzee that researchers say shows ability to reason analogically.

Sarah was given problems like having to determine whether a can opener is to a can what a key is to a lock.

In another trial, Drs. Douglas J. Gillan, David Premack and Guy C. Woodruff at the University of Pennsylvania Primate Facility gave Sarah an apple, an apple seed and an orange, and she had to choose either an orange peel or an orange seed to complete the match. She was right in the analogies more than 70 percent of the time.

Probably the most surprising finding was that Sarah's ability at analogical reasoning was not restricted to perceptual problems where she could detect relationships by looking at sizes, shapes or colors, but that it also worked for conceptual problems, where she had to know and remember something about the functions of different objects, Dr. Premack said.

Alton Blakeslee

CONTINUUM

SOLAR FRENCH FRIES

The sun has been used to warm homes in winter to power satellites in space to run office computers and even to make synthetic fuel. Now it's going to be used to do something equally important: to make french fries.

It's part of Ore-Ida Foods' plan to compensate for the rising cost of fuel. The project, sponsored by the Department of Energy (DOE) and designed by TRW, involves a battery of solar collectors located in a field beside Ore-Ida's Ontario, Oregon, plant.

In the process, water is steamed by the collectors, then used to heat the fryer's oil temperature to 417°F.

So far, though, the solar project is still in the experimental stage. DOE still wants to see whether it will really work.

In the meantime, Ore-Ida, besides sponsoring a companywide conservation program, is running a small methane production plant that uses potato throwaways for the raw ingredients. A larger one, says Ore-Ida's Susan Gerhart, speaking from the company's new energy efficient corporate headquarters in Boise, Idaho, could replace ten to twenty percent of a particular plant's power if it becomes necessary.

As to Ore-Ida's embryonic solar project: If it does succeed, the company may convert all of its fryers to solar heat. Then, with its cheaper energy costs, you may see less expensive french fries at the supermarket. — Kenneth Jon Rose

If your experiment needs statistics, you ought to have done a better experiment.
Ernest Rutherford

At last, a worthwhile use for solar energy. Ore-Ida wants to use solar collectors to create steam to heat frying oil to 417°F.

Our only hope lies not in making people feel emotional but in showing them what can be done and giving them reasons for doing it.
B. F. Skinner

The woman named Tomorrow
sits with a harpoon in
her teeth
and takes her time
and does her hair the way
she wants it.
Carl Sandburg

TALKING TOMBSTONE

It started as a joke at a summer barbecue. Michael O'Riley of Sunnyvale, California, said what this country needed was a good solar-powered talking tombstone. Many spare time man-hours later, the country had one, patented by O'Riley, an electrical contractor, and Stan Zelazny, a neighbor and an electrical engineer.

Zelazny and O'Riley's company, Eternity Monument Works, now offers a tombstone – powered by the sun – that will deliver a 90-minute message when activated by a special electronic key. The price tag is $10,000.

Though the inventors keep the inner workings of their device generally shrouded in mystery, they describe its corpus as a four-inch diameter metal tube, roughly a foot long, roughly because each device is custom-made for its tombstone. One end reproduces sound; the deceased's voice or a eulogy to him; the other houses the actuating mechanism. The tombstone is cored, buried, and the tubes placed inside with only the ends exposed.

Once buried in the tombstone, the devices guaranteed for two generations,

"Silent as a tomb" may no longer be a valid cliché.

about 40 years. Zelazny, once worked with NASA and he incorporated technology from the *Pioneer* spacecraft in the design. In addition, he subjected the prototype to a basic engineering thermal cycle that is, he cooked it and froze it for weeks in order to ensure optimal reliability.

The only unit sold so far rests in a monument to World War II dead at a park in the Colorado Rockies, where reliability under conditions of extreme cold is paramount.
Stephen Robinett

Children of the future age
Reading this indignant page
Know that in a former time
Love sweet love was
thought a crime.
William Blake

Right to-die movements gain new ground as scientists prolong lives of the terminally ill

THIS WAY OUT

BY ROGER M. WILLIAMS

On a late March morning in 1975, in a country house in England Derek Humphry handed his wife a lethal potion of sleeping pills and painkillers mixed with coffee. Jean Humphry, forty-two, was dying of bone cancer. She was determined to take her life with her husband's emotional support and active assistance.

As the Humphrys made their final preparations, Derek marveled at Jean's calmness and attention to detail. When he broke into tears, she reminded him gently: "I can't take any more of this cancer. I'd rather die peacefully today enjoying your presence and love in my own home than in some grim hospital after being

PAINTING BY GOTTFRIED HELNWEIN

knocked senseless with drugs for a couple of weeks. This is the best way.

Jean Humphry did die that morning. Derek, a journalist, could have kept the manner of his wife's death private, but he chose to reveal publicly this dark area of human affairs: the treatment of the terminally ill. Humphry published *Jean's Way*, his account of the entire episode, which aroused controversy in Great Britain and far beyond. Questioned by the police, he freely confessed to having "aided and abetted suicide"—a crime in England and much of the United States. The authorities declined to prosecute.

Derek Humphry now lives in Santa Monica, California, where he leads a right-to-die movement—that is, the right of an aged or terminally ill person to will his or her own death, with the understanding or perhaps even the complicity of family, friends, and physicians.

The practice, more properly termed voluntary euthanasia, is being promoted with increasing vigor by organizations in this country and abroad. Hemlock, an aptly named group that Humphry founded a year ago, now numbers about 1,500 members, with the total growing at the rate of 30 a week. Most of the members are couples in the thirty-to-fifty year age bracket. 10 percent are facing a terminal illness. "We have all types," Humphry says, "including doctors, nurses, and clergymen."

Hemlock has just made available to its membership a controversial book that reports, with sympathy and gritty detail, the true accounts of people who ended or tried to end lives they regarded as no longer viable. Although suicide tips can certainly be gleaned from these stories, Humphry emphasizes that the book concerns life as much as death. "It counsels survival as long as possible and, when it's no longer possible, sensible preparation for the end—that is, dealing with matters of timing, who to tell and not to tell, psychological and legal effects on one's family, and so forth."

Far more explicit—and socially abrasive—is a how-to guide to suicide that Hemlock's British counterpart, Exit, is struggling to publish over fierce opposition. This book-to-be contains recommendations against various methods of suicide, along with lucid descriptions of five approaches that really work. Exit, which presently faces litigation in Great Britain, is unwilling to reveal many details. But one method involves intentional drug overdose, with a chart that lists fatal amounts of some 200 prescription and nonprescription drugs. The book also discusses the pros and cons of death by asphyxiation and by electrocution in the bathtub.

"We recommend the reasonably peaceful and nonviolent ways," says Nicholas Reed, Exit's general secretary. "No shooting or hanging. We come out against wrist slashing, because it hardly ever works and makes a mess of the hands, and against common overdoses, such as aspirin and painkillers, which just damage the body."

The book boasts an eloquent and moving introduction by the eminent philosopher of science Arthur Koestler, a staunch supporter of Exit.

Derek Humphry predicts that voluntary euthanasia "will be the next major social issue." Demographic studies lend credence to his viewpoint. The American birth rate has been declining steadily since the 1920s, with the exception of the postwar baby boom. If present reproduction trends continue, an estimated one third of the U.S. population will be old in 40 years' time. Dialysis machines, respirators, chemotherapy—these and other medical technologies keep the elderly alive longer with fewer members of the younger generation to care for the sick and the dying. More and more diseases will end in lingering death at a staggering financial cost to survivors or through medical insurance, to the public at large. How many of us would opt for a pain-free and dignified way out of such predicaments to help save our families?

> *"One recommended method involves a drug overdose, with a chart that lists fatal amounts of some 200 prescription and nonprescription forms of medication."*

The right-to-die movement is gaining on numerous fronts. The dissemination of millions of so-called living wills is perhaps the most tangible sign of its enormous following. These will direct medical authorities not to prolong life if the signer has become terminally ill. They were first accorded legal status in 1976, when California passed a Natural Death Act which gives competent adults the power to discontinue life-sustaining treatment. Under the law any doctor who feels his ethical principles violated can remove himself from a case rather than be a party to euthanasia.

Besides California, the following states now have natural death legislation on the books: Arkansas, Idaho, Kansas, Nevada, New Mexico, North Carolina, Oregon, Texas, and Washington. Movement activists consider the laws of Kansas, New Mexico, and Washington the best in that they permit the necessary document to be drawn up at any time, not just when an individual becomes terminally ill.

"That's very important," says Alice V. Mehling, of the Society for the Right to Die (SRD), one of two long-established groups working to legalize such wills. "A dying patient may not be *able* to make his wishes known. This statement should be treated like the last will and testament, what if the law said you could execute a will only when you're terminal?"

SRD now has right-to-die committees in several states. The committees lobby for natural death acts and keep the public informed of developments favorable to the cause. A second organization, Concern for Dying (CFD), split from SRD several years ago and now concentrates on what it calls educational activities, including informational mailings. A. J. Levenson, executive director of CFD, says: "We believe legislation is unnecessary, except perhaps to protect the doctor involved against criminal charges. Actually, we're not certain doctors *should* be protected with a blanket release. They should be held accountable for the practice of sound medicine."

As an organized cause in the United States, voluntary euthanasia dates from 1937. In England it dates from two years earlier, and it's England's Exit that led the way into an uncharted part of right-to-die territory: the dissemination of self-help suicide information. Exit succeeded the original Voluntary Euthanasia Society, which had been known for its British reserve and strong antipathy toward suicide.

Bearded young Nicholas Reed changed all that. He marketed euthanasia aggressively and made the society at least neutral on the issue of suicide. Yet Reed had to wage a three-year internal struggle to get Exit's executive committee to agree to publish the suicide handbook, *A Guide to Self-Deliverance*.

When news of the tempest hit the press early last year, interest in both the handbook and the Exit organization soared. In less than nine months membership quadrupled, reaching 8,000. Not counting the British Exit's home constituents, Americans account for twice as many respondents as any other nationality. By June 1980 the group had enlisted 250 American members, receiving an average of ten queries a day from the United States. (The enrollment categories, with a touch of black humor, include "life member.")

A basketful of recent letters to Exit produced at least a dozen bearing States de addresses.

A California woman: "My religion does not condone suicide, however my parents are in their eighties and had cancer in 1976. Should I reoccur, I want to make a decision for myself and to be supportive of my parents, regarding a dignified death."

A California man, "[m] over sixty years old, rather [and, if at all possible I [underscored three times] want to make a decision for deliverance."

A Providence, Rhode Island man: "Having been brought up under strict Roman Catholic tradition, I appreciate hearing that there are those who do not believe one must suffer the agonies of terminal illnesses that fate deals."

An Ohio woman, a "cancer patient":

cons der myself very sane want very much to l ve if at a l poss ble but I do not w sh to be a use ess vegetab e or a finan- c al and emot ona prob em

Among other Americans who have requested either nformat on or the su cide handbook itself were a chiropractor from New Jersey and the coordinator of Late L fe Counse ing Services at a large Midwestern medical center

Th s correspondence s rece ved w th sympathy approaching passion by the Ex t staff members almost a l of whom have been personal y touched by death One e derly woman a former actress who did not want to be dentified told me of watch ng her father succumb to cancer "They sa d he d ast six months but he dragged on for sixteen n the m ddle of that he had a heart attack and the doctors brought him round to d e of cancer Right now I have a very good friend w th mu tp e sc eros s She soon be bedr d- den and n a bad way I definite y fee that euthanas a is the answer for her, and so does she

Janet Burne also of Ex t says it has 'been my fate' to see a succession of friends d e ingering and painful deaths Most people who condemn euthanas a she observes have never been asked by someone c ose to he p them die

Marsh D ckson a spr ghtly seventy two year-o d saw his mother who had a brain tumor botch a su cide attempt w th an underdose of pi s and h s wife suffering w th mu tip e sc erosis die after a wholly deb itating slide

But Dickson s most vivid memory s of a Burmese jungle trai n World War II When his Br tish Army un t was ambushed there by Japanese so diers and one of h s men was hope essly wounded Dickson says I did what the man begged me to do put him out of his m sery with a bu et f my own w fe had asked I d have done exactly the same for her

Experiences like those are what prompted Ex t to pub sh *A Guide to Self Deliverance* thereby ra sing the eth cal d lemma of su cide for al ages rather than s mply the question of euthanasia for the e derly Although ha f of the handbook is devoted in Reed s words to why *not* to comm t suic de the other half which deta s the five dead y ways has provoked alarm and condemnation

At this wr ting pub cation was still being delayed for fear of prosecut on Meanwh e Exit s Scottish offshoot not bound by Eng- sh law has already published a version of the book ent t ed *How to Die with Dignity* And one Dutch euthanasia society stim- ulated by Exit s efforts has put out a s m tech n ca vo ume instruct ng physic ans on dosages and other procedures that w l en sure the success of "just fied euthanas a "

Even without its handbook Eng sh Ex t has got nto troub e with the aw Last sum mer London police summoned Reed for quest oning about the su c de of Mrs Het tie Crysta a mu tip e sc erosis patient who

CONT NUED ON PAGE 90

We Invented Golf. The Least We Could Do Was Also Invent Scotch.

Inventing a complicated game like golf was a devilish thing to do. The small ball was easy to lose. The clubs were hard to carry. The goal was invisible from the starting point. Trees, water, and other friendly things were transformed into natural enemies of man.

It seems only right that we also invented scotch. Because after a relaxing afternoon of thrashing and cursing through a frustratingly rearranged countryside, a person might well enjoy a scotch.

That's why we made J&B a scotch with especially soothing taste. A taste that whispered while you recovered from an afternoon of relaxation on the golf course.

J&B is a carefully chosen collection of Scotland's finest whisky. It's blended for smoothness and subtlety.

By the way, it's probably not true that the only reason we invented golf was to give people more reasons to drink scotch.

J&B. It whispers.

86 Proof Blended Scotch Whisky © 1981 The Paddington Corp NY

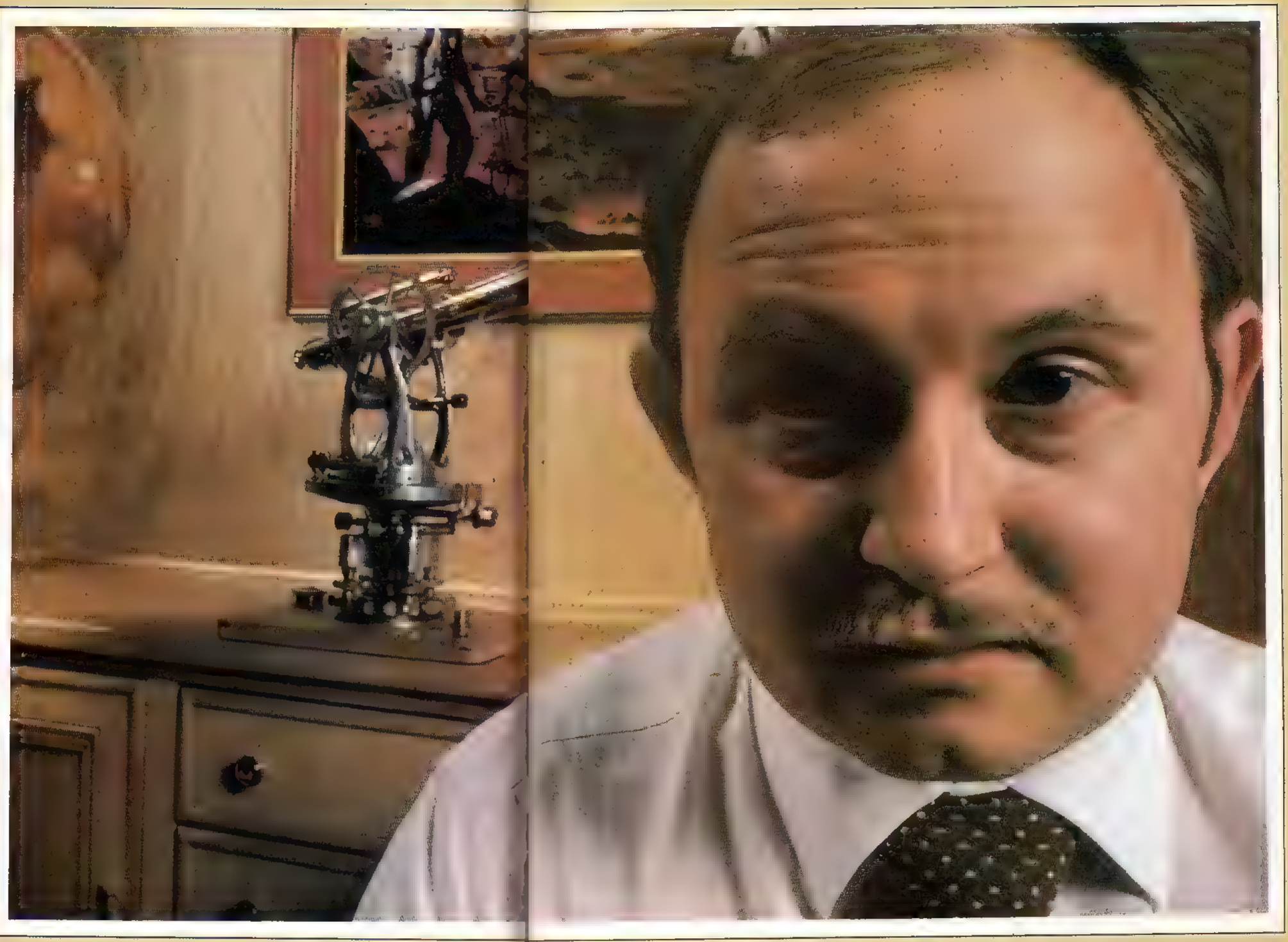
OMNI PROFILE

International law could block space efforts by private enterprise — but not if lawyer Art Dula has his way

COSMIC COUNSELOR

PHOTOGRAPH BY MALCOLM KIRK

BY RON BITTO



After meeting Art Dula it's easy to picture him 25 years from now. Seated in a geodesic lunar courtroom, his ample figure lends an authoritative bulge to his judicial jump suit. He leans forward on the bench and begins his history lesson. Space law, he points out, traces its roots to the Corpus Juris of the Roman Empire. The two lawyers he's lecturing have heard it before, but they listen respectfully to the moon's first federal jurist. Then Judge Dula reads his decision, settling a corporate dispute over molybdenum mining in the Sea of Tranquillity. He allows extraction to begin immediately.

Today, at thirty-three, Arthur M. Dula is a blend of technologist and legal historian, an ardent advocate of free enterprise who looks to the past for guidance and to the future for vast new opportunities. He is probably the first private attorney in America to devote his practice solely to aerospace and technical law.

Dula's office occupies the second floor of a restored Victorian house in Houston's Heights, an inner city neighborhood slowly being redeveloped. A topographical map of Mars hangs behind his massive desk, above his right shoulder. He talks enthusiastically into the telephone. To burn off nervous energy, he pulls an ivory handled .45 automatic from the desk drawer, removes the clip, and lines up the cartridges on

his blotter like a row of tin soldiers. Then he reverses the process, slowly reloading the gun and returning it to the drawer.

Last week a delegation of European lawyers attended a seminar on technical law that Dula conducted at Louisiana State University Law School. During the course he promised them a tour of the Johnson Space Center in Houston. Today he is phoning one of his many contacts at NASA to arrange the visit.

"We've got to impress them with the space program," Dula asserts repeatedly. "We've got to show that America is serious about putting business into space. These guys are from Europe's biggest banks and financial institutions. Can't we arrange for something off the public tour to make them feel special?"

Dula's friend bends a few rules to set up a Saturday tour.

While Dula often sounds like a self-appointed public-relations man for the American space program, his true vocation lies not in promoting NASA but in helping companies solve the legal problems of introducing new technology and making a profit from it on Earth and in space.

Dula's practice is wide-ranging. A few of his clients are earthbound. One is a Mexican company trying to introduce a new windmill to the United States. Another has developed a way to produce electricity and fresh water from ocean waves. And a client on the East Coast has a chemical process that turns wood chips directly into ethanol, eliminating the energy-intensive distillation now used to produce gasohol.

But several of his clients hope to profit from space itself. Dula acts as a patent lawyer for Eric Drexler, who has invented an improved solar sail. And he represents a company that has developed a new type of rocket engine. He also works for a group of businessmen interested in launching a private space vehicle.

Often his clients' space technologies offer benefits for life on Earth. One company Dula represents has developed a way to refine moon rocks and extract such elements as oxygen, silicon, aluminum and titanium. "Lunar material seems an awful lot like the fly ash collected in precipitators at coal-fired power plants," the Texas attorney points out. "Every year electric utilities in this country collect enough of this ash to fill the Grand Canyon. This technology could turn one of our most noxious wastes into a valuable resource."

"The more I get involved in high technology," he notes, "the more I see this synergy between aerospace and Earth. Technology developed for space almost always has benefits on Earth."

Dula's clients take up only part of his time. Much of the rest he spends as a legal theoretician, writing about laws that could enable business to operate profitably in space. Dula sees a bright future for mankind beyond Earth's gravity.

The great fortunes of the next century will be made in the asteroid belt, the attorney maintains. By the year 2020, a significant fraction of humanity's gross world product will be derived from space-based activities.

Transportation to Earth orbit will be routine and inexpensive by then. He expects sail- and solar-sail spacecraft will routinely traverse the inner solar system. Mature businesses will manufacture goods, generate electricity and gather information in orbit, while private enterprise will be exploiting asteroidal minerals that are processed in orbit.

Once profit – that is, new real wealth – begins to flow back to Earth, Dula projects, investment in space operations will accelerate as world corporations go after profits greater than those possible on the post-industrial Earth.

Unfortunately, the laws that govern technology – and particularly space law – are evolving at a much slower pace. That leaves many gray areas where the law has not been set. And to Dula these am-

> *"Unless we develop some practical laws to govern our activities in space, we shouldn't be surprised when war breaks out over who has the right to develop the solar system."*

biguities are more than dry legal theory. They could, he believes, discourage investment in space. At least one might even block space development by private enterprise entirely.

Part of the problem lies with NASA itself. Dula feels. In 1978 he wrote a report for the agency detailing the ten most important factors inhibiting participation in the shuttle program by nonaerospace companies. Most were rooted in the NASA Act, our national space law.

For example, NASA controls America's only launch facilities and has discouraged the development of private booster systems. The agency retains all patent rights to technologies developed in operations that involve it in any way, and its administrator can reveal any trade secrets used in experiments on the shuttle. This alone is enough to keep many companies that rely on unique technology from launching experiments on the shuttle.

And Dula believes that NASA's charter discourages cooperation with companies other than the aerospace giants. The agency is set up both to promote space activities and to regulate them. In short, concerns that deal with NASA tend to become captive industries.

Moreover, NASA's policy has been to concentrate on the academic and military use of space, playing down commercial possibilities. Communications and weather satellites – the two areas where space technology is improving life on Earth and doing so at a profit – are outside NASA's jurisdiction. They are handled by Comsat and the National Oceanographic and Atmospheric Administration, respectively.

By neglecting commerce while working closely with big aerospace contractors, NASA has failed to tell potential shuttle customers about the opportunities in space. Dula proposes to remedy this with a more aggressive public-relations program for NASA. He also suggests teaming nonaerospace companies with experienced space contractors to help the newcomers deal effectively with the agency.

Dula's concern with such issues is an old one. Robert Heinlein's science fiction convinced him long ago that mankind should not be limited to its home planet. Heinlein's works even influenced his choice of schooling. "I agree with Mr. Heinlein," Dula says, "that anyone who doesn't understand math ought to earn it. It's basic to understanding the universe. And in a technical society, he knew, even a lawyer needs a strong background in science. So as a pre-law student at Eastern New Mexico University, Dula majored in chemistry and took his minor in mathematics.

He has since built a collection of Heinlein first editions, and the science-fiction art that lines his office includes a watercolor by Ann Layman Chancellor depicting the opening scene of Heinlein's novel *Citizen of the Galaxy*. Heinlein himself saw the picture at an art show and recognized it as the scene from his book. "Dula remembers with a smile.

Leaving New Mexico, Dula went to Tulane University's law school in New Orleans, where he made the law review. He retained an ambition to manufacture starships, but he also gained a deep interest in Earth's legal traditions. Today his science fiction library shares a room with a collection of ancient lawbooks.

This interest in the history of law clearly marks Dula's approach to space law. The Romans gave nations jurisdiction over their territory from hell up to the sphere of the fixed stars, Dula points out. That's where we get our concept of airspace. So the Roman Code is really the starting point for laws governing space.

But a more recent episode of history has even clearer implications for space development, Dula feels. "Whenever academic laws have been arbitrarily projected into the future," he says, "there have been disastrous consequences. When Pope Alexander the Sixth drew the Line of Demarcation in the year 1494, dividing the New World between Spain and Portugal, he left out England and France. The result was decades of war over the ownership of the

resources of the Western Hemisphere."

The Texan worries that similar confrontations may be built into today's international space law. "Unless we develop a practical law governing activities in space, we shouldn't be surprised when war breaks out over who has the right to develop space resources," he warns.

Current space law prohibits the "occupation" of space. Such permanent establishments as space stations and lunar mining facilities would therefore violate international treaty. The geosynchronous orbits a solar-power-satellite (SPS) system would require—now nearly filled by military and communications satellites—also violate this prohibition.

Partly because of this ban, there is no accepted way to assign grazing rights to orbits in space. Eventually the most desirable orbits will become filled. At that point it isn't hard to imagine that a power with killer satellites might decide to clear private craft out of the positions it needs. Investors would find "range wars" in space a difficult hazard to accept.

But the threat that worries Dula most is already in progress. The one thing that could stop the development of space by free enterprise would be to outlaw making a profit in space, he says. The Soviet Union and Third World countries are now attempting this through the Moon Treaty.

The 1967 Treaty of Principles and the Moon Treaty, under debate in the United Nations and signed but not ratified by the United States, proclaim that the resources of space are the common heritage of all mankind. This is a lofty-sounding principle, but it is vague. Neither treaty spells out exactly how this heritage is supposed to be divided.

If ratified, the Moon Treaty would forbid private ownership of minerals on the moon and on other "celestial bodies." But without ownership, there can be no profit. And as Dula points out, free enterprise does not move where there is no profit.

"Unfortunately, international space law is based on academic and dangerous treaties designed to choke the development of free enterprise in outer space. Space may be the common heritage of all mankind in a philosophical sense, but the resources actually developed by private industry must belong to the entrepreneur who had the vision and took the risk to obtain the benefit."

And that risk, incidentally, should all be on the company's shoulders. Yet the treaty on international liability for damage caused by space objects states that national governments have an absolute liability for damage caused by objects launched from their country.

"Pan American World Airways flies everywhere in the world," Dula reminds us, "with vehicles bigger and heavier than the space shuttle. Their planes would do more damage if they crashed. Yet no one seems upset because Pan Am stands liable for its own damage." The attorney fees that

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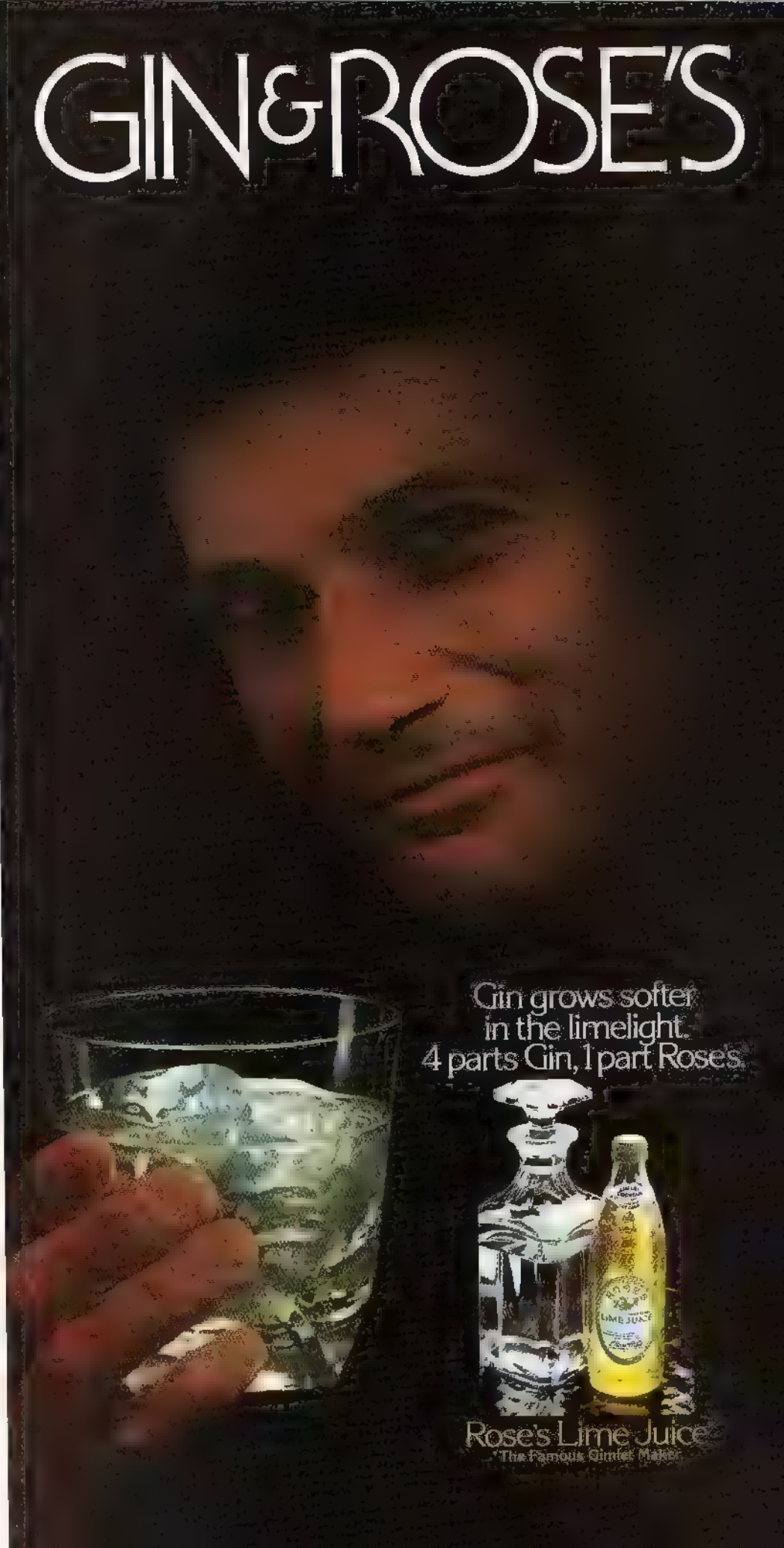

FICTION

He dreamed of first contact with a being from another galaxy

VOYAGERS

BY BEN BOVA

Stoner lay on his back in the cramped spherical capsule of the *Soyuz* spacecraft, helmet on, visor locked and sealed, gloved hands resting on his knees. He was sweating. His legs dangled up above him, like a turtle on its back, he thought. Useless and in danger.

He turned his head to see Federenko in the left seat, but his helmet blocked his view. He could hear the cosmonaut, though, in his earphones, chatting happily with the launch control engineers in Russian.

Federenko's gloved fingers flicked across the switches of his control panel like those of a pianist testing a new instrument. One by one, the banks of lights lit up.

"Stoner," the Russian's bass rumbled through his helmet.

"Yes?"

"You can pick up the countdown at Teh minus one meenute, at my mark." A short pause, then, "*Mark.*"

T minus one minute. Stoner heard the Russian words in his earphones.

T minus ten seconds, Stoner counted mentally.

He could feel his heart pounding wildly as he went on. Five, four, three...

The booster trembled beneath them. Pumps starting up.

One, zero.

He heard the Russian word for *Ignition!* and felt the whole capsule shudder. A dull growl from somewhere deep within exploded into an ear-shattering bellow as millions of demons howled their loudest and a heavy, implacable hand squeezed down on his chest, pressing him into his seat and shook him with bone-jarring violence.

Stoner felt the breath forced out of him. His eyeballs were pressed back in their sockets. He couldn't lift his hands from the armrests. His spine was being crushed. And the noise. The noise and vibration rattling him.

The mind-numbing roar eased away and finally died altogether. The pressure dwindled until Stoner saw that his arms were floating free of the seat rests. He felt lightheaded, and for a moment his innards told him that he was falling. After squeezing his eyes shut hard enough to make them tear, he finally opened them, and he was no longer lying on his back but sitting upright in the *Soyuz* capsule. Nothing had changed but his perspective.

"Shtoner," Federenko's deep voice

PAINTING BY MITCHELL JAMIESON

rumb ed in h s earphones 'You okay?'

He nodded Okay, N kola . m f ne You?"

All good "

Stoner s vision was b urred "Okay to open my he met?

But Federenko was on the rad o, check ng back w th m ss on contro Stoner waited unt l he was finished then asked again

Yes yes Cab n pressure is normal All systems are good, ground contro confirms

Stoner sl d the visor up pulled his g oves off and wiped at his eyes The gloves dr fted out toward the contro pane and he grabbed at them grinning to h mself

Zero grav ty Federenko sa d 'You remember? Do not make crumbs when you eat

Stoner laughed and took a deep easy breath He was we ghtless and the p eas ure of it was eu phoric

"Was a good aunch, no?"

'Perfect' Stoner sa d

'Now we make contact w th *Salyut* by rad o, then go dock w th equ pment and supply vessels "

Stoner pulled out the cl pboard that was mounted on the panel to h s right n both Russ an and Eng sh l sted every task they must perform the day and hour it must be started, and now long they had to complete each

'You make the f rst EVA Stoner said

Da'

watch the store'

Federenko peered from around the edge of h s he met Watch store?

"It s an American express on Stoner tried to exp ain it to h m

Federenko listened frown ng deeply "But there is no one here to stea from store

Shrugging ins de h s bu ky pressure su t, Stoner said "We Nikola you know how t is n a cap tal st society So many th eves that we expect them everywhere

t made no mpact on the cosmonaut 'But no th eves n orb t No thieves aboard *Salyut* They are both good Sov et c t zens, officers in Red Army "

The American gr nned and gave t up

Stoner scratched drows y at h s stubbly beard It was starting to itch and he onged for a hot bath Federenko, just as grubby and t red look ng sat ca mly n h s seat at Stoner s eft check ng the mission schedu e The command modu e sme ed of sweat and body heat

"Separat ng supply modu e is no prob em, Federenko was expla n ng Explosive bo ts snap cab e and push t away'

"That s the fourth t me n the past hour you've to d me ' Stoner rep ied 'It s worry ng you sn t t?

"No no s no prob em "

©1981 by Ben Bova from the forthcoming book *Voyagers* to be pub shed by Doub eday & Company Inc

'*Something's* bother ng you N ko a

The Russ an s unshaven face sank into a dark frown Not worry Shtoner But I see prob em we must dea w th "

"The tanker?

"*Da* We must nk with it before attempting to rendezvous w th a en, accord ng to f ight plan "

' know'

But atest radar shows tanker s not in best pos tion for us Tra ectory is deviating from plan

We can st reach t can t we?

Federenko nodded somber y "But will take more maneuvering fuel than planned eaves ess fuel for making rendezvous maneuvers w th alien

Stoner thought a moment We cou d et the tanker go and save our maneuver ng fue for the rendezvous '

"And have no prope ant eft for return to Earth ' Federenko said

'They could send up another tanker '

W th a gr m augh Federenko sa d n

'A flash caught his eye In total silence the tanker blew apart a trio of flashes followed quicker than an eyeblink by an enormous fireball that nearly blinded them'

how ong? Two days? Two weeks?"

"They've got a backup at Cape Canav era they were ho ding it n case the first tanker d dn't get off okay No problem '

By the t me backup tanker is aunched we wou d be on same tra ectory as a en— heading out of solar system Second tanker not reach us at a '

Shit'

'We must ink with tanker,' Federenko said f rmly even f it means no rendezvous with a en '

Chr st Nikola We've come a this way to make contact with that bird '

Is true,' the Russian rep ied ca mly 'But I have no des re to meet a en and never return to Earth Do you?'

Stoner d d not answer

You are sulk ng " Federenko sa d ater

Stoner pu ed h s attent on away from the comp ter screen and looked at the cosmonaut sitting bes de him

"You don't look so happy yourse f N kola '

"How can be? To come a this way and miss the a en It is not happy"

'I've been checking the computer figures against the latest data on the tanker's tra ectory We can st make it f you can dock us w th the tanker on the f rst pass '

Federenko closed his eyes for a moment, as f rehears ng the prob em in his head 'Not easy, Shtoner

Stoner cou dn t understand the babble of Russian coming through the rad o speaker but from the expression on Federenko's deeply l ned face he knew it was bad

The cosmonaut spoke almost angrily back to ground command and more ur gent words burst from the rad o

Stoner turned to the radar screen, a small orange-g ow ng d sk on the pane between their two seats t showed a strong b p a most dead ahead of them He stretched s ght y to search through the ob servation port and yes there it was A s very crescent of meta aga nst the starry blackness

The tanker C ose enough to see t But Federenko s g oomy frown sent a chill of apprehens on through Stoner

What s t, N kola?

Federenko turned toward him defeat sm der ng n h s eyes 'The tanker We must not go near t Ma function

'What?"

"Very strange, they te me Malfunct on n tanker se f-destruct c rcu t t can exp ode, they th nk

The cosmonaut's hands reached for the stubby levers that contro led the *Soyuz* s maneuver ng ets

"Wait!' Stoner ye ped If we don t link up with the tanker, we can t comp ete the m s s on'

' f we do link with the tanker boom '

Stoner sagged nside his restra n ng harness "I don t be eve t How could "

A f ash caught h s eye and they both craned toward the observat on ports n tota s lence the tanker b ew apart a tr o of sma f ashes fo owed qu cker than an eyebl nk by an enormous fireba that near y blinded them

Stoner squeezed h s eyes shut Federenko growled something too ow for Stoner to catch.

The fireba faded into darkness, eav ng a burn ng afterimage against Stoner s eyes There was no shock wave no no se no debr s pattering around them t was as f they had been watching a s ent picture Stoner cou dn t be eve it was rea

"Gone Federenko sa d heav y

Stoner rubbed at his eyes then looked out through the port again Noth ng but the unutterab y distant stars

Gone," he adm tted 'And where does that leave us?'

'We are dead men, Shtoner Without propellants from tanker we cannot get back to Earth '

It took a few moments for the realization to s nk in F nal y Stoner heard himse f say, But we have enough fue to make the rendezvous with the a en don t we?'

Federenko gave h m a ong so emn look 'Da ' he said at last P enty maneuvering

fuel left for us now tanker is gone Shtoner

Then let's do it " Stoner said 'That's what we came out here for isn't it? Let s do t Nikola !"

Federenko s bearded face almost smiled ' I knew you would say that Shtoner '

What else is there? Stoner asked, feeling strangely excited 'Let s go!

They came on the alien craft with the sun at their backs The radar image had been fuzzy almost nebular at the longer wavelengths But when Stoner turned on the microwave radar, the image cleared up immediately and showed a smaller but much sharper blip

Now for the first time he saw the spacecraft itself

It glowed with a strange eerie golden light like an aura that surrounded the solid craft The spacecraft was embedded in the glowing light From this distance it was still too far away to make out details, but it appeared to be roughly oblong with a smooth surface and rounded corners

"What is the light?" Federenko asked

'A screen of some kind Stoner guessed 'A screen of energy like a magnetic field maybe To protect it against cosmic radiation Maybe a shield against micrometeors, too "

They were closing fast on it Stoner floated out of his seat and wormed his way back to the orbital module of the *Soyuz* Taking the stubby compact telescope from its clips on the equipment rack he focused on the alien ship through the nearest observation port

If it s come all this way from another solar system it must have been in space for hundreds of thousands of years at least, he called, loudly enough for Federenko to hear him on the other side of the open hatch But its surface looks smooth and completely clean No meteoric erosion at all No pitting

What is color?"

Squinting through the telescope, Stoner said 'Hard to say The light around it makes everything look kind of golden '

"Are cameras recording?'

Stoner glanced at the equipment monitor panel The camera lights were on So were the video transmitter lights Yes,' he called

Stoner watched for what seemed like an hour as they glided closer to the spacecraft and Federenko spoke to ground control The spacecraft s surface was absolutely featureless, as smooth as the skin of a supersonic aircraft Not a rivet not a seam not even a line of decoration

Then he realized that they were not getting any closer Leaving the telescope hanging weightlessly he ducked halfway through the connecting hatch

"You can get us a lot closer, Nikola It won t bite us

No closer' Federenko said firmly

"Come on we "

"Orders from ground control They are working on new course for us Get us back to Earth '

Terrific But in the meantime we re here '

' Not to use maneuvering fuel ' Federenko said Take photographs Describe spacecraft for radio and tapes "

'But we can rendezvous with the thing!' Stoner insisted For Chrissake, it s only a stone s throw away "

Too long a throw You are Olympic champion maybe?

'Come on, Nikola!

'Must not use maneuvering fuel the cosmonaut replied stubbornly ' Orders Our lives depend on this

Stoner pulled back into the ovoid orbital module and peered out of the observation port at the alien craft It was close enough now to make out clearly with the naked eye It hovered against the stars tantalizingly near, its golden energy screen glowing pulsating slowly

They seemed to be at rest now, compared to the alien vehicle They rode alongside about a hundred meters off its flank riding silently against the stars close enough to touch too far away to touch Stoner knew that their placid seemingly motionless encounter was an illusion Both craft were hurtling away from Earth flying farther from safety each second The alien was heading out of the solar system, back into the unthinkable gulf between the stars and unless they broke away and took up a new trajectory Stoner knew that he and Federenko would also leave Earth s grip forever

He stared hard at the alien spacecraft, knowing that a million miles away men and women were working frantically to find a

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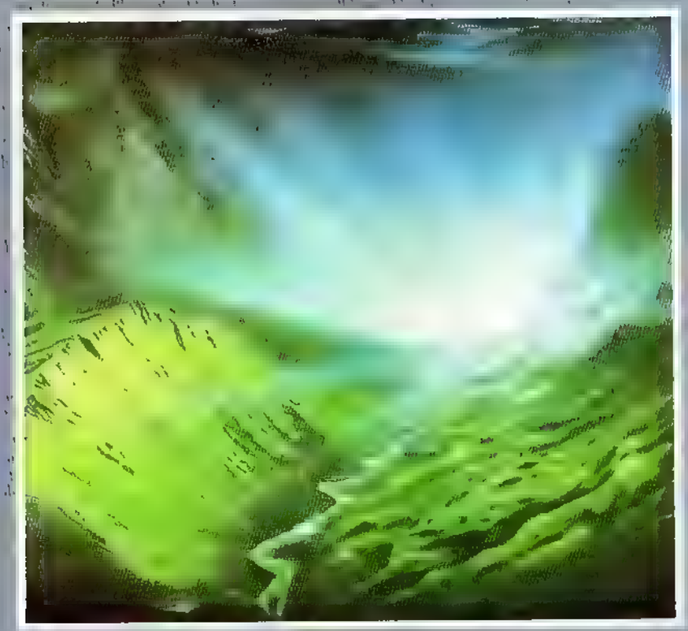
Perfect gardens of primeval origin spring from our genetic memories

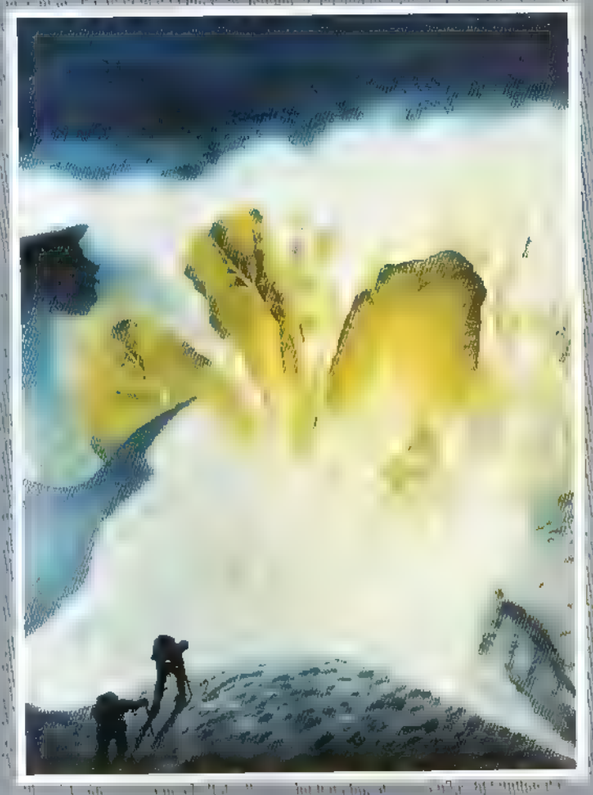
GREEN WORLD

BY ROBERT SHECKLEY



Our Golden Age was at the beginning. But what came before the beginning? First among created things was the originally perfect world. Eden, a place of nature alone existing before the arrival of the gods or the birth of humans. This primordial place has been called the Green World. Eden's perfection presents an archetype of the

PAINTINGS BY FRIEDRICH HECHELMANN



human spirit as old as mankind itself It is a place known
to artists who are elucidators for the visions
of the human race The Green World, where water, mountain,
forest and sky interpenetrate, can be
apprehended only through the divine logic of aesthetics.
Friedrich Hechelmann shows us images
of a prehuman world, a terrestrial heaven waiting in its
innocence for mankind to come along and
trash it Many ancient legends are in agreement concern-
ing the origins of Green World In the Hindu
cosmology there were four ages, the first being the
Krtayuga or time of perfection. Hesiod recalls
the archaic Greek view of a Golden Age when men lived
like gods, eating only acorns, wild fruit, and

honey that dripped from the trees untroubled by old age
undisturbed by death Similar stories are
found among the Mayans and Aztecs Greek Hindu
and Indian cosmologies share another
notion The early perfection was followed by a decline
through four or more ages, leading at last
to our own Age of Iron According to these myths, our age
ends in destruction and the rebirth of a new
world which is followed by its destruction cycle after cycle
throughout the lifetime of the universe.
Converging myths too often reflect the longing of
humanity not its accomplishments We
anxiously await signs of an Elysian epoch that will
probably again, take place without us

FICTION

THE MICROBOTIC REVOLUTION

BY IAN STEWART

There's no future in robot miniaturization," I said. "Microelectronics, using optical etching techniques, maybe. But microbotics? No way. Look at the trouble Detroit Medicalds had with its microsurgery devices. Especially the one for the inner ear." I should know: I'm a sales rep for an outfit that sells medical instruments. I'd driven down from Coventry that morning, trying to persuade Bristol's Royal Infirmary to ditch its bone-cutting forceps in favor of a portable laser.

PAINTING BY YOSHIHIRO USHIYAMA

They'd agreed it was a marvelous idea and shown me the new lasers they'd just bought from Takahashi Optronics. Still, I did get them to promise to order their pelvic pin joints through us in the future, so the journey wasn't entirely wasted after all.

Whenever I'm in Bristol I try to look up Oliver Gurney. He lived there for years and knows the city like the wrinkles on his elbow. Especially the pubs. His current favorite is the Tall Ship, in Upton Stourby, an old stone building with sagging rafters.

It was a cold night, but the fire in the lounge bar of the Tall Ship was burning brightly as the ale flowed, and I warmed to the topic. "Control, Oliver, *that's* the problem. Like threading a needle from a distance of ten feet in a hurricane." I lowered the level of my mug by a good two inches and leaned my elbow on the bar. "Same again, please, Janice."

Oliver is some sort of Top Frog in a firm called Deca Electronics. He likes to think of himself as an engineering entrepreneur. His enthusiasm for a new idea is boundless and often clouds his judgment, which is lousy at the best of times. But every so often he has an idea that is truly mind boggling in its audacity, and he makes it work. I suppose you could call him an erratic genius. This time he had a bee in his bonnet about pea-sized robots. His pudgy face, with its beetle-browed eyes, bore an expression that I had known of old.

"What we need," he said, "is a new approach. I concede, Johnny, that you can't build microscopic robots *directly*. But I think you could do it in *stages*."

Come off it, Oly. The more stages you use, the worse the problem gets. Like rounding errors in a long computation, blowing up and swamping the answer.

"Maybe you can leave a few out."

Maybe. What's the limiting factor on the size of pocket computers?"

He grinned. "The size of pockets."

I wasn't very amused. "You know I mean, on how *small* they can get, not how large."

"Ah. Serious task. Er . . . making the buttons big enough for fingers to push them."

Right! Whatever size you want to end up with, *it all starts here*. People. And people are pretty *big* in mechanical terms. Billions of cells, trillions, maybe. I forget. Compared to a single virus, that's huge."

Oliver looked at me thoughtfully. "Have you ever noticed how small viruses are to tiny robots?" he asked. "I remember a picture of a bacteriophage that looked rather like a lunar lander with a kind of syringe on stilts up the middle. And the flagellae of bacteria are little Archimedean screws running on circular bearings."

But nobody *builds* a virus. We can't even *synthesize* one of any real complexity!" Then I realized we had strayed from the point. "Anyway, what I mean is, to get down to microbots in *stages*, your suggestion—involves too long a chain of command. So the errors accumulate too much." It was a good argument, I thought. It certainly convinced *me*. Not that I was in a very critical frame of mind by then.

Oliver's eyes glazed over completely. For a moment I thought it was the ale. Then he slammed his mug down on the counter. "I just have to find a way to stop them from accumulating," he said.

I didn't see Oliver again for a month, though I was in the Bristol area twice during that time. Deca Electronics seems to have a finger in every pie, from laser-powered toasters to particle-beam benders, and Oliver often gets dragged halfway across the world on business with only ten minutes' notice.

The third occasion I phoned from Cardiff and Oliver was back in circulation. We agreed to meet at the Tall Ship. He breezed in with a tatty-looking cardboard file under one arm, hauled me off into a corner and shoved an engineering diagram in front of me. It looked like a cross between a mechanical grab and a helter-skelter, and I said as much. He hastened to explain.

> *"There are times when it pays to listen to Oliver. He is bright but also a trifle sloppy. One crazy idea in twenty works. But when it does, it makes up for the nineteen others."*

It's the preliminary blueprint for the Oliver Gurney Reduplicating Engine," he said proudly.

Reduplicating?

Portmanteau word. Cross between *reducing* and *duplicating*."

Engine?

Makes for a better acronym. OGRE."

"Oh." I asked how it worked.

He edged closer in conspiratorial fashion and edged away, and we both moved some two feet along the seat until I was wedged into the corner. "Basically," he said, "it's a modification of one of the standard replicating automata."

For once I understood what he was talking about. "You mean that thing at MIT that builds copies of itself?"

"Yes. The Japanese have one, too, and the Russians have one."

"But that relies on a supply of spare parts and a stock of magnetic cards to copy the program on, and . . ."

He held up both hands as if to ward off the flow of words. "Mine doesn't."

There are times when it pays to listen to Oliver *carefully*. He's very bright, but also a trifle sloppy and about one crazy idea in twenty actually works. But when it does, it makes up for the nineteen others. I guess that's how Deca Electronics sees it, too.

Mine makes its own spare parts out of any material that comes to hand. Metal, mostly, and bits of plastic. And when it builds a copy of itself it does it on *one tenth scale*."

"Clever idea, Oliver," I said. "You make one big one, and that makes a medium-sized one, and that makes a small one, and that makes an even smaller one . . . but it won't work."

"Have you ever tried to tell a mother that her newborn offspring resembles an apoplectic capuchin monkey?" He actually sniggered at me. "*Why not?*"

"The smaller it gets, the more the molecular structure of the materials changes in relation to the size of the components. You can't shrink atoms, Oliver."

"Thank God. I thought maybe you'd thought of an obstacle I'd missed. I've programmed it to modify the design as it shrinks in size. This involved other modifications, too. It was rather complicated, but he seemed to have it all worked out. The process had to stop at some point, anyway, and he had programmed the machine to stop reproducing when it had reached macromolecular size.

But what about the error buildup?

"There isn't one. I've arranged it so that the machine corrects its own structure on the basis of its internal programs. And those are just copied. With a good error-correcting code there's no difficulty."

I tried another tack. "It looks very complicated. Won't the first stage be rather big?"

"Not with off-the-shelf components. About the size of a Hi-Bug."

"Expensive?"

"Not as much as you'd think. You'll be glad you invested in *this* idea."

"I'm sure. *What did you say?*"

He clutched at my arm, perhaps to stop me from getting away. "It's a money spinner, Jonathan. Imagine it: *a robot no larger than a bacterium!* It'll be the biggest thing since the microchip."

"I think you mean *smallest*. Oliver. Now look, I've got better things to do with my money than . . ."

"Oh, come on! All I need is three hundred pounds. I can get a lot of the stuff out of my research budget at Decal, and I've got a few quid put away for a rainy day myself, but I'm three hundred short."

"Get a bank loan."

"Umm. Well, you remember how I got an overdraft to finance that development project for microwave socks to keep feet warm in cold weather. National Westminster caught a bit of a cold on that one."

"Say no more. I get the picture. Anyway, I don't have—"

"You'll regret it if you refuse. *Think of the possibilities!* And you'll have a stake in the ground floor. Once it takes off . . ."

"Oly, it's a funny ground floor that can take off with a stake in it. It's just . . ." On the other hand, maybe he was right. It was a

small enough risk and the returns *might* be *huge*.

"All right, I'll forgo the new hall carpet. Half shares?"

"Of course."

He'd said that too quickly. "Hang on. I want half shares in the *profits*. I absolutely *refuse* to accept responsibility if anything goes wrong!"

"Done. A check will do fine. Payable to Oliver B. Gurney. Lovely!"

He tucked it into his wallet. "Painless, wasn't it?"

"So far. I'll answer that when the analgesic effect of the alcohol wears off."

Decal Labs is on the outskirts of Bristol in an old country house in the village of Menderby, not far from Bristol Parkway railway station. The building's exterior is much as it was two hundred years ago, but the inside has been ripped out and totally rebuilt.

Oliver had built OGRE in the basement. I was astonished at how quickly he had managed it. He explained to me that once the design was specified, the construction was easily performed by using a standard assembly robot and a critical tree quasi-bootstrap technique.

"Conceited bastard!"

But I had to admit it was impressive. It just about filled the basement. The bulk was a lot of electronic modules, with a few induction motors and belt drives. Around this was a kind of machine tool assembly line, wound from top to bottom in a spiral. Right on the top was a hopper with a mechanical grab arm. The whole thing was mounted on caterpillar tracks, and if you looked carefully you could see a retractable hook in each segment of track.

Apparently the hooks were for climbing up things.

"Where's the barn door, Olly?"

"Eh? Oh, no, *this* one stays put. The tracks are for later generations to scavenge for materials. I put them on this one only to see how they'd look."

"And where does this one get the materials it needs?"

He pointed. "Those garbage cans over there. The next generation uses these little bins *here*, and later generations cannibalize previous ones."

"Aha. Reviving the ancient art of matriphagy. But isn't it rather costly to let them eat up all that machinery?"

"They won't eat much. There's only one machine in each generation. I suppose they might bite a few chunks out of Mama's caterpillars. The scavenging [illegible] be fairly efficient for the process [illegible] chance of working at all. Fra[illegible] sure I could stop the babies [illegible] Mama if I wanted to. You [illegible] they have to recognize who Mama [illegible] that means a lot of extra programming memory and such."

"But in any case [illegible] he broke [illegible] ingly a little embarrassed. "Well, the big machine is mostly made up out of Hong Kong copies bought at knockdown prices on the black market. But don't let IBM know or they'll cancel all our service contracts."

"I looked around me. A thick cable ran from a plug on the wall. "Where do the offspring get their power from?"

"There I cheated. The second, third and fourth generations use batteries. After that they get small enough to rely on solar power. By the seventh generation there's enough energy in starlight."

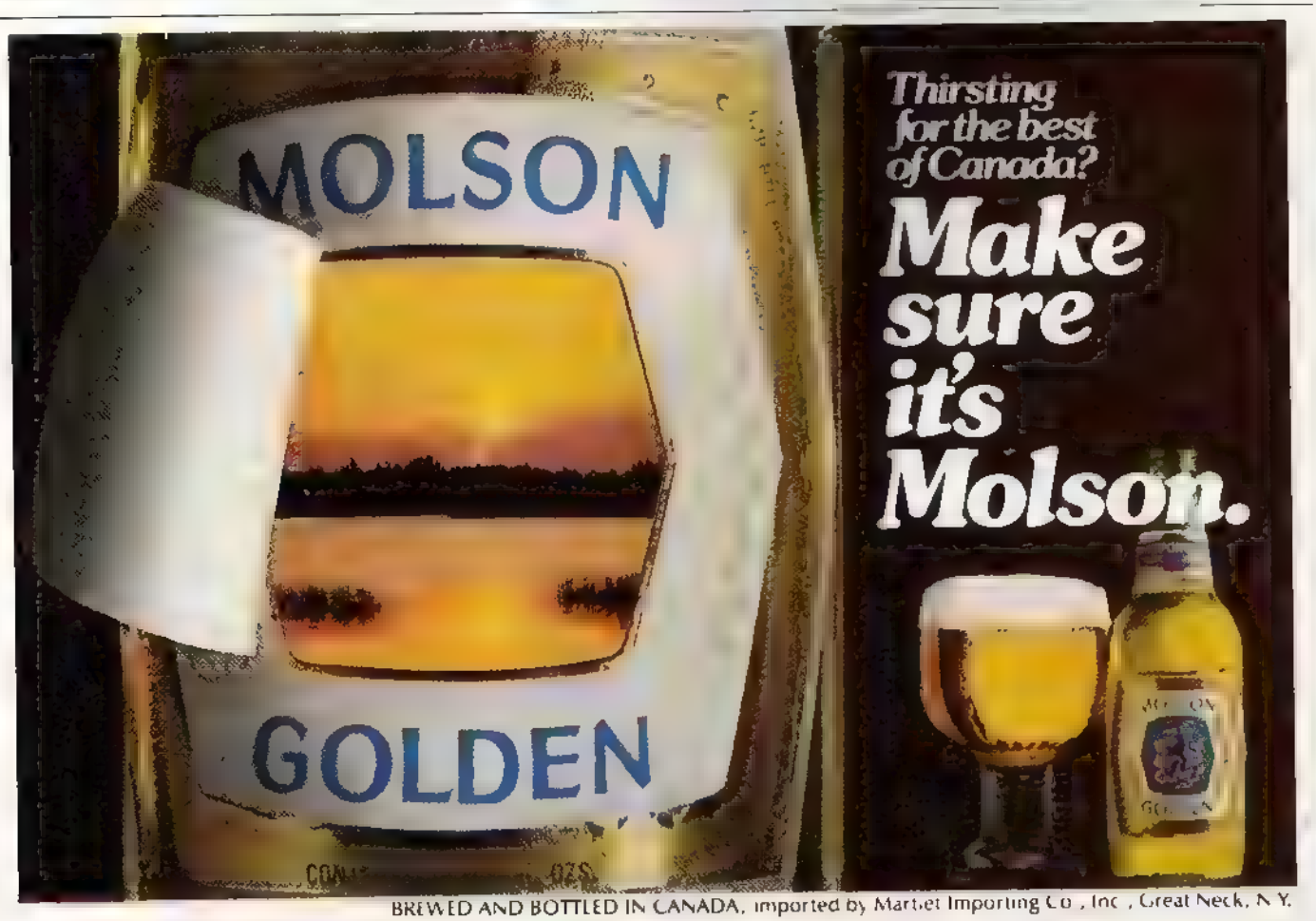
"Much more to do?" I asked.

"Nope. Just some final programming. Hang on ten minutes and I have it done."

So I hung on. It was almost certainly the biggest mistake of my life because it made Olly rush the programming job and not check it properly. Anyway, he rattled away at a keyboard in the corner for a while, then grabbed the magnetic programming card and shoved it into a narrow slot in the side of OGRE 1, first generation matriarch.

He threw the switch.

Progress was pretty slow to begin with. "It should take about three days," Oliver said. "But that time shrinks as the machines get smaller. Everything goes by a factor of ten at first. The next size takes about seven hours, then forty minutes, then four minutes, and so on, and so forth. The whole process drops off eventually when it gets [illegible] seconds, mind you."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A diary from 1899
could give us the sun's power
within five years

PROJECT TESLA

The chamber is vast, empty, dark. Footsteps click on the cement floor. Muffled voices echo in the eerie, dim shadows.

The very air crackles. A low hum, ominous with electrical power, builds and builds, and then—

An immense bolt of lightning bursts the darkness, sizzling blue-white energy that writhes and roars deafeningly, turning the world into a terrifying stage where more than 20 million volts of electrical energy blasts down from nine meters overhead and cascades to the barren floor.

Abruptly the lightning bolt winks out, leaving an ear-ringing silence and ghostly afterimages of light.

In an abandoned airplane hangar in Utah, where the first atomic bomb was assembled, Project Tesla has created another bolt of man-made lightning. Someday—soon, if the man who directs these titanic bolts of energy can find the funding—it might create a practical fusion generator.

With the overhead lights on and the Tesla equipment turned safely off, the hangar resembles a latter-day Frankenstein's laboratory. Robert Golka, a mild-looking, soft-spoken forty-year old, is director of Project Tesla and president of Pyrosphere, Inc.

Robert Golka (left), seen with his lightning machine, is retracing the work of Nikola Tesla (above)

PHOTOGRAPHS BY DAN McCOY

Robert Golka literally plays with lightning.

In his laboratory, on the site of the former Wendover Air Force Base, Golka can generate lightning bolts of 25 million volts and he has plans for even more energetic experiments. His 150,000-watt Tesla coil routinely produces what Golka believes to be the largest continuous man-made lightning discharges in the Western Hemisphere.

Golka insists that his studies of lightning have opened a way to produce a sustained nuclear fusion reaction.

In the fusion-energy process light atoms of hydrogen isotopes such as deuterium are heated to temperatures of tens or even hundreds of millions of degrees centigrade. Under high enough temperature and pressure deuterium nuclei will fuse together producing helium nuclei and enormous amounts of energy.

Physicists know of three ways to produce the conditions under which sustained nuclear fusion will take place.

Gravitational containment is the way the sun and other stars produce fusion conditions. But it takes some 10^{27} tons of hydrogen to hold together with gravity the fusion generator that is a star.

Magnetic containment is the avenue by which most fusion researchers have approached the problem, trying to hold the

star-hot deuterium plasma together with powerful magnetic fields

Inertial containment is the key to other fusion experiments. In these studies a beam of laser light or charged particles forces a pellet of deuterium to implode, releasing fusion energy. These experiments look promising, but many technical problems are yet to be solved.

Golka wants to use his man-made lightning in a fourth approach to fusion pressure containment. 'Since 1968,' he reports, "we have been looking for a way to hold very hot gases together without the use of magnetic fields."

He found the answer in work originally done in 1899 by Nikola Tesla, the Croatian-American scientist who pioneered the development of AC electrical power. Tesla's work, the key to modern electrical-utility systems, has been for the most part forgotten by today's electrical engineers.

Tesla said that he had repeatedly produced small fireballs that persisted for many seconds after his coil—then generating 12 million volts—was turned off. Tesla devoted eight pages of his diary to a crude theoretical study of the fireballs, but after his death the experiments were forgotten and never repeated.

Then in 1970, Golka tracked the diary to the Nikola Tesla Museum, in Belgrade, Yugoslavia. From Tesla's notes he recreated the high-voltage machine, later doubling its power.

Working with Professor Robert W. Bass of Brigham Young University, Golka founded Pyrosphere Inc., to test the fusion scheme that emerged from this work. The experiments at the Tesla Laboratory supplemented by mathematical analyses have convinced them that stable discharges of ball lightning can be produced and can yield continuing fusion reactions.

Ball lightning is a rare spherical discharge of electricity often suggested as the source of many UFO reports. A weird, multihued cracking glow, it hovers momentarily in mid-air, darts unpredictably about, and then vanishes. Golka and Bass think they can 'chain' artificial ball lightning in a pressure tank and build within it the furious temperatures and pressures needed for fusion.

The Free Ball fusion reactor would work by focusing a carbon dioxide laser beam to a pinpoint at the center of a metal sphere filled with hydrogen and deuterium gas. This, Golka believes, would create a firecracker-sized explosion, just as sunlight shining through a magnifying glass ignites a piece of paper.

This explosion would start the focal point of four more infrared lasers, placed at the corners of a tetrahedron. The lasers would be chosen to emit light at a wavelength from which the plasma could absorb energy efficiently. As the plasma took in energy, the deuterium gas pressure in the tank would be built up gradually, allowing the fireball to reach a temperature of 1.5 billion degrees in 30 minutes.

At that point, Golka's correct fusion could begin, and the lasers could be turned off. Each hydrogen-deuterium pair that fuses together makes a helium atom and shoots off two neutrons at high speed. The neutrons have no charge, and so they travel effortlessly through the onion-like layers of positive ions and negative electrons that make up the fireball.

The fusion tank would be lined with a water jacket. When high-speed neutrons strike water, they are slowed and convert a little of the hydrogen in the water into deuterium. They also heat the water, just as the spinning disc of an automobile brake heats the pressure pads that slow it. In the Free Ball reactor the water would be turned to steam and the steam used to turn a turbine-driven generator. Alternatively, the water might be broken down into hydrogen and oxygen, and the hydrogen would be used as fuel.

Would it work? A good many fusion experts claim not. But Golka thinks the skeptics are simply prejudiced against the work of people outside the government and academic-research establishments.

"We can prove or disprove this theory inside of two years," he told *Omni*, "at a cost of two million dollars. But the Department of Energy won't listen to us. Considering that the department intends to spend $20 billion on fusion experiments over the next two decades, Golka's request for funding seems modest indeed.

Other experimenters also have hopes of using Tesla coil-generated discharges to produce useful electricity. Former astronaut L. Gordon Cooper, president of the Center for Advanced Technology in La Jolla, California, where a research team plans to use a precisely tuned Tesla coil to tap energy directly from Earth's electrical fields. Tesla himself first proposed the project in 1900. He later claimed to have carried it out successfully but died without revealing his techniques.

When Tesla announced his hope of producing 'free energy for the world,' his financial backers, including John Pierpont Morgan, withdrew their support, ending his work. Golka, who dreams of using Tesla's ideas to make nuclear fusion practical, ironically faces the same critical problem. With research budgets being cut back in a time of fiscal austerity, it seems doubtful that a maverick like Golka can raise the funding he needs.

"All we want is a running chance," says the man who harnesses lightning. ∞

A sex therapist talks about men and women in love, and why female orgasm is only an evolutionary luxury

INTERVIEW

HELEN SINGER KAPLAN

Photographs by Tony Guccione

The questions might have been pondered by a tabloid's advice columnist. What is love? Are women naturally faithful and men fickle? Is a happily-ever-after marriage incompatible with human biology?

No greeting-card gush spoils the subject when sex researcher Helen Singer Kaplan — physician, psychoanalyst, and animal behavior and learning theory Ph.D. — scrutinizes human mating practices. It could be, she concludes, that neither men nor women are especially suited to lifelong marriage.

Musing on human sexuality is a favorite activity of sociobiologists, who trace our romantic preferences to ancient biological imperatives encoded in our genes. Voicing the sociobiology hard line while eschewing the label, University of California anthropologist Donald Symons has proclaimed (Interview, March 1981) that men and women are very different sexual creatures. That's because natural selection has fashioned a basically polygamous male brain and a stand-by-your-man female brain.

Male reproductive success is a matter of impregnating as many women as possible, Symons explains. So men are genetically programmed to yearn for ever greener sexual pastures. In contrast, women, handicapped in the state of nature by pregnancy and childbearing, have evolved sexual caution. While men are attracted to youth, physical beauty, and unwrinkled skin — all emblems of female "reproductive value" — women find high status" males desirable without regard for physical appearance.

Is Symons right? Do hunter-gatherer values still operate in singles bars? Or is his book *The Evolution of Human Sexuality* a love-'em-and-leave-'em manifesto, offensive to feminists and true-love believers alike? Dr. Kaplan, who teaches human sexuality at Cornell Medical Center, in New York City, and directs New York Hospital's human-sexuality program, is certainly in a position to answer these questions for us.

Kaplan's work is part of a movement that passed from the Stone Age to the Nuclear Age in just two decades. The Vienna-born

"Typically, everyone, except the most neurotic individual, falls in love. But most of us stay in love for a relatively short time — several years. In human beings romantic love often doesn't last a lifetime."

therapist remembers her first job, at New York's Metropolitan Hospital in 1964 where she dispensed a kind of sex therapy not unlike the operating instructions for an appliance. There was no time for long-term treatment of poor women with sexual problems, she recalls. So with very brief behavioral instructions and diagrams I showed them where their clitoris was and how much time they needed for arousal. I was amazed it helped about ninety percent of my patients! And when I went to Cornell in 1970 I started to treat men as well, with the same surprising results. Nowadays innovative methods are used to treat many sexual difficulties that had previously been regarded as incurable.

Beyond the nuts and bolts of sex, however, is the realm of male-female attraction, fantasy, love, bonding, and even happy 60-year marriages, all of which are discussed in Kaplan's current book. Now, for *Omni*, she explains her views of human sexuality to writer Diane Klein.

Omni: Do you share Donald Symons's view that human male sexuality and female sexuality are markedly different for biological reasons?

Kaplan. I agree that there's a very strong biological element in all sexual behavior and that there are profound male-female differences that are biological. That's not to say, of course, that cultural factors are less important. But there's a male sexuality and a female sexuality, though one is *not* inferior to the other. They are complementary.

And I share Symons's view that evolution provides a fruitful way to look at human behavior, by considering how behavior helps us survive and reproduce successfully. But I disagree with Symons about what these male-female differences are, and I disagree with many of his conclusions.

Omni: Will nonsexist education fail to eradicate differences in sexual behavior, feelings, and attitudes?

Kaplan: Even if we bring up boys and girls in exactly the same way, they will probably not turn out the same. If you raise a bull and a cow in a nonsexist environment, they're not going to act or look the same. Yet animals vary in their gender differences. In some species the sexes look so much alike you have to check their genitals. For instance, you can't tell by observing a dog's behavior or appearance whether it's a male or a female, except when the female's in heat. We humans are somewhere between canines and cows in that respect.

Omni: What's your opinion of Symons's theory that there are differences between male and female brains, just as there are differences in the genitals?

Kaplan: That is no longer a theory, it's an established fact. We don't know fully what it implies, but just as the bodies of males and females are complementary and fit together for the purpose of reproduction and survival, the brains of males and females are somewhat different physically. Perhaps that's so our behavior patterns can fit together as beautifully as our bodies do.

You see all the many differences between males and females are brought about by testosterone. Without the testosterone a male fetus produces, it would develop into a female. Later on, during adolescence, there's another big jolt of testosterone in the male. Many of our tissues, not just those of the genitals, are sensitive to sex hormones. The muscles, the skeleton, the skin cells, and the brain all have testosterone receptors. That's why we see profound differences not just in the way men and women look, but in how they behave, too. If you give a woman this male hormone, she'll begin to grow a beard in two weeks, and she's likely to feel sexier.

Omni: What do you see as the main difference between male and female sexuality?

Kaplan. I think all the differences between male and female sexuality are due to the strength of the male sex drive, which seems much higher than the female's. All other differences follow from that.

The male sex drive is so compelling that it's less subject to inhibition by learning than the female's, which is more variable, flexible, and influenced by experience. A woman can be aroused and have more orgasms than a man, but she isn't driven to sexuality the way a man is. The male sex drive is much more difficult to suppress. For example, if you tell a little girl not to masturbate, she's likely to listen to you, but a boy will continue to masturbate, in part because his urges are much stronger. I'm not saying there aren't crucial cultural factors present in sexuality, of course, but I believe the biological factors in our sexual behavior have been neglected.

Omni: Is that why females rarely develop perversions?

Kaplan: Exactly, but I don't like to call them perversions; sexual variations is a better term. When a young girl's sexuality is treated harshly, she tends to become asexual, but a harshly treated boy is more likely to develop an alternative expression for his sexuality, perhaps in the form of a fetish. I have never seen a woman fetishist. Females will not become aroused by looking at a shoe or fondling a glove, yet for a male such objects often become symbols of forbidden sex.

Omni: Is this powerful biological male sexual urge in accordance with Symons's theory that men innately desire sexual variety more than women do?

Kaplan. I totally disagree with Symons's conclusion that men want and need a greater variety of sexual partners. Clinical experience makes it crystal clear that both men and women are pair bonders. We form strong monogamous pairs, and this is basic to human experience.

When Symons describes men who are looking for sexual variety, he's looking at men who are not in love or who are between love relationships. He confuses the experience of the unattached male with men who are emotionally involved. A man doesn't need or want diversity when he's with a woman who meets his sexual fantasies.

The ovestruck man has eyes on y for h s ove and n fact he tends to overvaiue and idea ze her ove s a k.nd of ovely mad ness for men and women a.ke

Omni What .s the cl nical description of the phenomenon we ca l falling n love?

Kaplan: It's a romant c bond between two peop e that s formed so rap dly, you almost feel there's a bio og ca aspect to t and it s a un versal experience The visua compo nent is very important What a man or a woman looks ke seems crucia in the n t a attachment The relat onsh p .s h ghly vu nerab e at f rst A harsh word, a c umsy act on, or any unpleasant occurrence can break the bond unti t is 'set A though the instant bonds don't always become ong term attachments they can, and signific ant love re ationships often begin rap.d y at first s ght Such an attraction may not be a good ong term love relat onsh p because love s highly comp ex with many e e ments But the basic romantic sexua. at tachment s an important ngred ent, w th out it, you have merely a cordia partnership between two peop e

Omni. Are we, then basica ly monoga mous, rather than polygamous as Symons bel eves?

Kaplan· No one knows for certa n but be eve so Most cultures are based on a monogamous mode it s such a un versal thing For .nstance in certa n segments of soc ety young kids have much more sexual freedom than prev ous generations had but they re not promiscuous When you leave k ds a one w thout compe ing them to do anything except what makes them fee good they' usua ly form pa rs

n fact, coup es are health er and live onger than sing es Monogamy s not just a fema e predi ect on Men want and need it, too Actua ly males show more s gns of stress when they ose a mate It's true how ever, that males are nighly sexed and even if they're attached, they wi function and enjoy it if they should find themse ves n bed with a beautifu woman But that's not the same thing as hunting for women and crav ng d versity I have a so seen some peop e who do desire sexua variety and when they're not gu ty about it they can be content But such behav or s atyp.cal

Omni. Do you th nk that if Symons had studied ov ng couples, he wou d have come to different conc us ons about monogamy?

Kaplan That s correct f someone s hap p y attached he w ll not active y seek out other partners And f Symons had any clin ical experience and understood the lone ness that men and women fee when they re not connected—the pa n, the de press on the angu sh of search ng and not find ng someone to ove—he couldn t have made such a ,udgment

Omni What e ements are necessary to an endu ring ove re ationsh p?

Kaplan. There are on y so many bits of be nav or that have evo ved, and these are adapted to different c rcumstances For examp e mutual attachment is character st c of a mother and her baby, s nce the immature .t e one cou dn't surv ve without the system of behav or between mother and young Both mother and baby fee upset when separated and feel good when they are close They are h ghly empathetic sensit ve to each other's sma est d scomfort They don t compete and the mother s protective and s ow to anger even f the baby wakes her up n the middle of the n ght w th ts cry ng

That sort of mutua caring s ncorporated nto the romantic bond Lovers are typica y very uncomfortable when they re apart They take great p easure n being c ose and car ng for each other Competition is m nima and nothing seems too much trou e f t s for the one you love Add to the parental k nd of bond the bond of sexual attract on two peop e who meet each other s sexua fantasies which s a very important part of a ong term romant c at tachment and you have the glor ous state of being n ove

Omni: Are humans fet me bonders?

Kaplan· I don t know whether we re fet me bonders ke geese or gibbons, wh ch stay with one sexua partner a their ives That s a successfu strategy for the r surv va just as n other circumstances promiscu ous sexua ty is a successful surv va strategy Symons's book nd cates that the on y sens b e strategy for surviva s male prom scu ty f that were true there wou d be no monogamous spec es, and there are very successful monogamous spec es on th s earth

m address ng myself to the quest on of what kind of bonders human be ngs are by ntensively study ng certain wonderful atypica coup es who are sti g owing with each other after twenty th rty or even forty years Unfortunately, these peop e are the exceptions n our soc ety Typica y, every one except the most neurotic ind v dua fa s n ove But most of us stay n ove for relative y short per ods of time, per haps three seven, or ten years n human be ngs it doesn't often last a l fetime n many marriages the caring part of the re at onsh far out asts the romantic sex ual attachment

Omni· s that because of the present longevity of our spec es?

Kaplan. That s an nteresting quest on The anthropologist Margaret Mead be eved we were headed for ' seria monogamy' because of our ong l fe span Our l fe in the wi d was probab y about fifty years f we were very lucky In a harsh environment a person older than that cou dn't see we enough or run fast enough to surv ve But I don t th nk most peop e stay in ove romantically with their mates We could be three-year bonders, or eight year bonders think the birth of a baby can lengthen the bond

Omni. Symons points out that the phys.ca attractiveness and des rab l ty of fema es everywhere is dependent on their youth

You have got to learn to delegate responsibility '

and unwrinkled skin. Is this a universal standard of female beauty, independent of environmental influences?

Kaplan: I am afraid I have to agree with that. That's why women wear makeup and try to look young. And it's foolish not to recognize the universal appeal of the younger woman. I think it's ludicrous to say this is due to advertising or social conditioning. However youth is only one element of falling in love, and attractiveness is a complex variable. Older women can be very appealing to men since we're a very intelligent species, and a woman's voice, warmth, intelligence and especially the way she fits into a man's sexual fantasy are compelling ingredients. Once you're in love, if that bonding is firmly established, age doesn't really make any difference. You can remain each other's fantasy throughout life. I'm studying eighty-year-old women who are still enormously attractive to their husbands, and I'm studying the same situation with older men and their wives. In seeking *new* relationships, men tend to look for younger women.

Omni: Do you envision any changes in men's criteria for female desirability as women become more powerful in status and earning power?

Kaplan: The youthful complexion will always be an element. But it's not the only element. There are in fact men who are attracted to older, more powerful women. They enjoy the role of the good boy, complementary to that of the protective, stronger mother." They can fall very much in love with such a woman who can provide other satisfactions. This has been true since the dawn of history. Queens, duchesses, and powerful older women have never had a shortage of lovers.

Omni: Do you agree with Symons that female orgasm is an artifact cultivated by skilled and caring men?

Kaplan: Yes. Female orgasm is an artifact from the viewpoint of evolution. In other words, we could have survived successfully as a species without female orgasm, but we could not have survived without male orgasm. The fact that female orgasm is an artifact doesn't mean it's not important. It simply means it wasn't a primary structure or function that evolved because it was adaptive; it's a by-product. Our brains, for example, were adaptive because we were able to survive and thrive in a variety of environments. By-products include our ability to play chess, dance and build pyramids.

The penis, of course, has enormous adaptive value. It can become very hard and carry the sperm deeply into the vagina, where it's safe. The clitoris comes from the same embryological origin, has the same nerves, and can transmit the same sort of pleasure. And the same muscles that are used in male orgasm propelling the semen also go into the pleasurable contractions of the female orgasm, but they don't have the same biological value. The female orgasm probably doesn't occur in a

CONTINUED ON PAGE 92

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THE VERY LARGE LION AND THE VERY SMALL MOUSE

Wherein the wily neutrino tries to tame the expanding universe

BY ISAAC ASIMOV

A mouse incautiously ventures within reach of a lion's paw. The lion spares it out of the generous impulse of the moment, and the mouse vows to repay the good deed. The lion naturally laughs at that. But then, some time later the lion falls into a net set by hunters and cannot escape. Providentially the mouse arrives. By gnawing through a number of the connecting cords the mouse frees the lion. Moral: Don't underestimate the importance of little things.

Since most of us feel helpless in the face of a harsh and unfeeling world, we enjoy reading about the power of little things: of Jack defeating the giant, of David beating Goliath. In fact the standard thriller won't work if Good and Evil are evenly matched. The Evil Menace must be all-encompassing, all threatening, all devouring, and the Forces of Good must be weak and all but helpless—yet somehow win.

As every writer knows, nature imitates art. Therefore it shouldn't be surprising that in the real world the smallest mouse can rescue and indeed dominate the largest, most ferocious lion.

Our universe is the largest lion imaginable. To describe it in the most general terms, let's start with Earth. A world rippling with life. Earth is part of the planetary system that accompanies our sun. The sun is part of a huge conglomerate of 300 billion stars that is shaped like a flat pinwheel, slowly rotating about its center. Such a system is called a galaxy.

Most galaxies are parts of groups or clusters. Our particular galaxy, the Milky Way, is one of a couple dozen galaxies bound together gravitationally that make up a galactic cluster. In our own galactic cluster, called the Local Group, most of the galaxies are smaller than the Milky Way, but at least one, the Andromeda Galaxy, is larger.

The Local Group is only one of millions of galactic clusters. Other clusters run to hordes of thousands of galaxies.

The universe then is made up of millions of galactic clusters, which are the largest aggregates of matter we know of. A big cluster is 60 million light years wide and flat, a vast pancake of matter.

Every distant galaxy is the source of particles that radiate outward in all directions. The most important of these are photons, or units of electromagnetic radiation that comprise not only visible light but radio waves, microwaves, infrared waves, ultraviolet rays, X rays and gamma rays. Photons travel at the speed of light—300,000 kilometers per second—and after millions to billions of years some of them reach our instruments. Only by studying these photons will we learn anything at all about the distant galaxies.

We can pass photons through a spectroscope and spread the visible light portion into a band, or spectrum, of steadily increasing energy. At one end is low-energy red light, at the other high-energy violet light. Crossing the spec-

PAINTING BY MARK RICKERSON

trum are dark lines representing missing photons of particular energy content

The dark lines occur because various types of atoms tend to absorb certain photons before they can be radiated out into space. Each type of atom produces dark lines at precise positions.

Sometimes those positions shift. For instance, if the source of light is receding from us, all the dark lines shift uniformly toward the red end of the spectrum—a so-called red shift. The faster the speed of recession, the greater the red shift. If light travels toward us, however, the spectrum shifts toward a higher frequency or the blue end. An object approaching us at high velocity is perceived to have the color of its spectral lines blue-shifted.

As it happens, the spectra of all the galaxies beyond our Local Group, without exception, show a red shift. Conclusion? All the galactic clusters in the universe are withdrawing from us.

The fainter the galaxies are, and presumably the more distant, the greater the red shift. Consequently, the farther a galactic cluster is, the faster it recedes.

But why should all the galactic clusters be fleeing from us? And why should they be receding at rates that increase in proportion to their distance? How can a galactic cluster know its distance from us? Why us?

In fact, we have nothing to do with it. The universe is merely expanding. Every galactic cluster is increasing its distance from every other galactic cluster. If we consider the universe to be uniformly expanding, then it is possible to show that it doesn't matter in which galactic cluster we are located: that all other clusters would seem to be receding from us at rates that are proportional to their distance from us.

Naturally, if the universe is expanding and getting bigger and bigger each day, it must have been smaller in the past. The further into the past we delve, the smaller the universe must then have been. If we took a motion picture of the expanding universe and ran it backward, we would see a contracting universe, and if we ran it backward long enough, we would see the universe contract to a point.

That point, the cosmic egg, apparently existed about 15 billion years ago. At that time, with all the matter of the universe existing in one point, there was a sudden inconceivable explosion, the Big Bang, in which energy came into being and slowly condensed into matter. The matter expanded and swirled into fragments the size of galactic clusters. The fragments condensed into smaller fragments the size of individual galaxies, these fragments collected into stars and planetary systems. And even though 15 billion years has now elapsed, the force of that cosmic explosion still sends the galactic clusters racing madly apart.

And what of the future?

It may be that the expansion will continue forever. Galactic clusters will move farther and farther apart until only our own Local Group could be reached by our instruments. The trillion or so stars in our Local Group eventually will collapse or drift into one or another of the black holes that now exist or that may evolve in the future. The universe will then be, to all intents and purposes, dead—and dead forever.

But this expansion is occurring against the pull of the overall gravitational field of all the stars in the universe. Under that inexorable pull, the rate of expansion is decreasing. At some distant date in the future will the rate of expansion be reduced to zero? Consider the following scenario: The universe will remain static for a moment, then, under the same inexorable pull of its own gravitational field, it will very slowly start to collapse. The collapse would continue over hundreds of billions of years at a steadily increasing rate until everything in the universe came together in a big crunch. The rebound of another big bang probably would follow.

There are two possible scenarios for the universe. In one we envision a big bang and eternal expansion. This is what is meant by an open universe. And we merely exist in it for a little time, so long as a habitable planet is here at our disposal.

> *"If we made a movie of the expanding universe and ran it backward, we would see a contracting universe; if we ran it backward long enough, the universe would shrink to a point, the cosmic egg."*

In the other, the universe begins with a big bang and first expands, then contracts to a big crunch, then undergoes another big bang, and so on over and over. This is a closed universe. There are, in this scheme, an infinite number of habitable universes, one after the other, and we are merely in one of them.

But which is the correct scenario?

It all depends on the strength of the overall gravitational field of the universe. If the strength is greater than some critical value, then it is strong enough to halt expansion and close the universe. If the overall field is less, the universe remains open.

The strength of the gravitational field is dependent on how tightly the mass of the universe is compressed, that is, on the average density of the universe.

Given the present rate of expansion of the universe (or what astronomers think it is), the average density of the universe must be at least 5×10^{-30} gram per cubic centimeter if the universe is to be closed. That isn't much, for it is equivalent to one hydrogen atom in every 340.65 liters of space or so. But the universe is so huge, even such low density is the equivalent of 25 sextillion stars the size of our sun.

The trouble, however, is that as nearly as scientists have determined, there are only about a hundredth that many stars in existence. The actual density of the universe is only about a hundredth the amount needed to close the universe, and so the universe is open and will expand forever.

An open universe, however, is a puzzling one. Where did the universe come from? How did the original cosmic egg come into being? Why did it explode at one particular time and not another?

A closed universe is somehow more comfortable, since we need only postulate that the universe has always existed and we can then explain the Big Bang by saying that it was preceded by a big crunch. The universe is always expanding and contracting, with no beginning and no end, with many big bangs and crunches, and the moment the Big Bang occurred is determined as the boundary between two stages of expansion/contraction.

But we can't close the universe without at least a hundred times as much mass as we can detect. This is the mystery of the missing mass.

It is not only the universe that is involved. Gravitational forces hold galactic clusters together, yet the clusters' total mass is not great enough to supply a gravitational field sufficiently intense to contain expansion.

Of course, we are aware only of the mass that we can detect. Is there mass that we can't detect? Are there dark bodies we can't see that possess the missing mass?

A black hole might have the mass of millions of ordinary stars and yet be totally invisible, there might be such a black hole at the center of every galaxy.

But it wouldn't matter. The mass of a galaxy is judged by its size and its speed of rotation, and that mass would include a central black hole, whether visible or not.

The missing mass, if it exists, is spread out along the outermost edges of the galaxies and in intergalactic space, where it wouldn't affect the galaxies' rate of rotation. That rate would depend largely on the concentration of mass in galactic cores.

There is a powdering of stars around the rims of the galaxies, along with vast clouds of dust and gas and possibly some black holes. At best, however, as nearly as astronomers can discern, there isn't enough mass in these galactic halos to solve the mystery of the missing mass. The halos might be enough to multiply the supposed density of the universe by 1.1 times, but certainly not by the necessary 100 times.

Let's consider the makeup of the universe on a more fundamental level. Forget stars, planets, and so on. Consider, instead, the subatomic particles that compose everything from atoms to stars.

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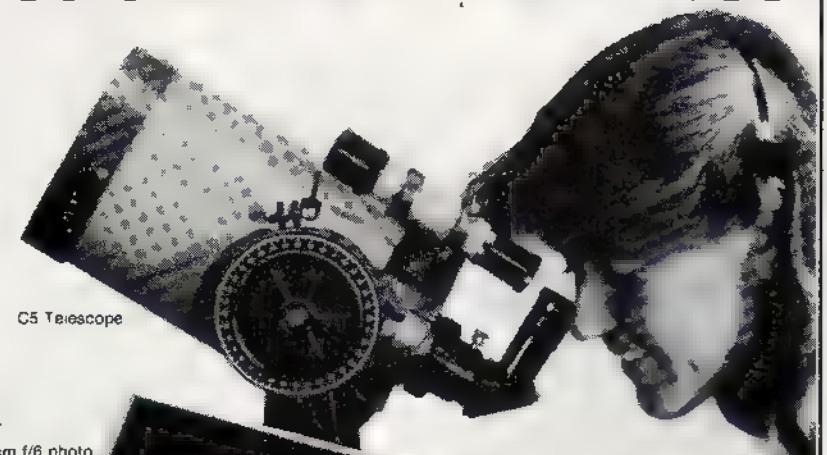

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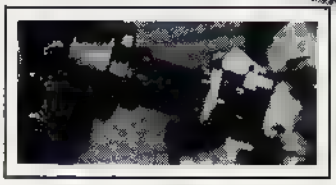

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of subatomic particles but almost all of them are laboratory curiosities that don't exist in nature in substantial quantity. There are no more than six subatomic particles that make up almost the entire universe: protons, neutrons, electrons, photons, gravitons, and neutrinos.

All of these particles are constantly in motion. The photons, for instance, move at the speed of light. This motion represents energy, energy as Albert Einstein has shown, is equivalent to mass. However, a considerable amount of energy is equivalent to only a small amount of mass. If only the energy of motion is to be taken into account, the amount of mass it represents in today's universe is negligible.

Suppose though, a particle is brought to rest. It may still have mass, even though its energy of motion is zero. This mass that persists when the particle is not in motion is its rest mass. The rest mass is an extremely concentrated form of energy. The energy that stars radiate is given off at the expense of less than 1 percent of the rest mass of the particles that constitute them.

If a particle has rest mass, even a small amount of rest mass, then it counts for much more than the mass equivalent of any energy of motion a particle might possess.

Three of the six subatomic particles, namely the photon, graviton, and neutrino, have a rest mass of zero. So, let's forget them. The three others have rest masses in the following ratio: proton 1, neutron 1, electron 0.00055.

The relative number of each of these three is: for the proton, 1; for the neutron, 0.12; for the electron, 1.

If we multiply the relative rest mass by the relative number, we get the relative contribution that each particle makes to the mass of the universe. It comes out: proton 1, neutron 0.12, electron 0.00055.

By this calculation, protons make up roughly 90 percent of the universe and neutrons make up the other 10 percent.

If this is true, then the mystery of the missing mass can have but one answer. There can't possibly be 100 times as many protons and neutrons as we think there are, which means there is no missing mass and the universe is open. The universe will expand forever, and the whys and wherefores of the Big Bang may possibly remain a puzzle forever.

The ion of the universe is thus trapped in the unbreakable net of insufficient mass. What we need is a tiny rescuer.

Such a rescuer, if there is to be one at all, can only be one of the three particles that I said had zero rest mass: the photon, the graviton, or the neutrino.

The photon and the graviton can't be the rescuer, for they are the exchange particles of the electromagnetic interaction and of the gravitational interaction, respectively. Both electromagnetic intensity and gravitational intensity fall off as the square of the distance, which fact has been checked with fine precision. If this is so, the exchange particles, the photon and grav-

ton must have zero rest mass

The neutrino however is different For one thing it is the only particle that is not constantly interacting with the others Protons and neutrons cling together in atomic nuclei protons and electrons cling together in atoms photons and gravitons are forever being absorbed and reemitted by other particles Otherwise they wouldn t be exchange particles

Neutrinos conversely are not exchange particles they pass through matter as if it weren t there Trillions upon trillions of neutrinos can pass through the earth from side to side and only a scattered few would be stopped The rest swerve neither to the right nor to the left they behave as if the earth were empty space

The neutrino is in a certain sense the tiniest mouse conceivable but there is nothing about it that absolutely requires it to have zero rest mass

As it turns out experiments conducted in the United States and in the Soviet Union in 1980 may have shown that neutrinos have rest mass perhaps 0 0001 that of an electron and therefore 0 00000005 times that of a proton

This may not seem like a rescue If the light electron contributes a negligible amount to the total mass of the universe the far lighter neutrino might certainly seem to be unimportant However scientists estimate that for every proton in the universe there are no fewer than 3 billion neutrinos Each group of 3 billion neutrinos would have a total mass equal to 165 protons even allowing for the fact that each individual neutrino has such a tiny mass

That means 99 3 percent of the mass of the universe would consist of neutrinos The protons and neutrons that make up the mass of everything we think of as the universe ourselves atoms planets stars are only the remaining 0 7 percent

If we now count in the neutrinos there is 166 times as much mass in the universe as we had thought and that is sufficient to close the universe

Is the mouse s rescue of the lion credible? Scientists in need of something to close the universe snatch at the neutrino

But the massive neutrino quite unexpectedly may solve other puzzles

Neutrinos are being formed constantly by the nuclear reactions that take place at the core of every star but a majority of those that now exist were formed not in this way at all but at the very beginning the moment of the Big Bang

Being so small so light and so unrelated to other particles neutrinos were able (according to the careful argument of Hungarian physicist Alexander S Szalay) to part from the thick energy mixture right after the Big Bang and proceed on their own For the next 100 000 years or so protons neutrons and electrons were unable to form as independent particles

Furthermore the neutrinos having rest mass could slow down Particles with zero rest mass such as photons and gravitons

CONTINUED ON PAGE 108

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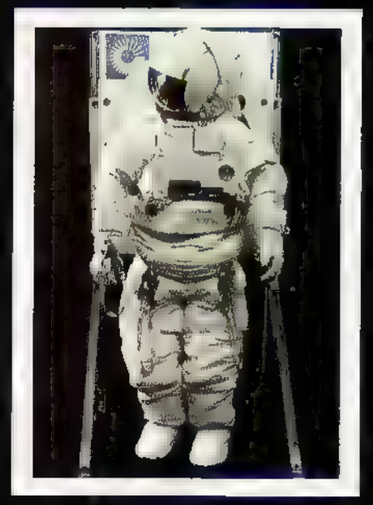
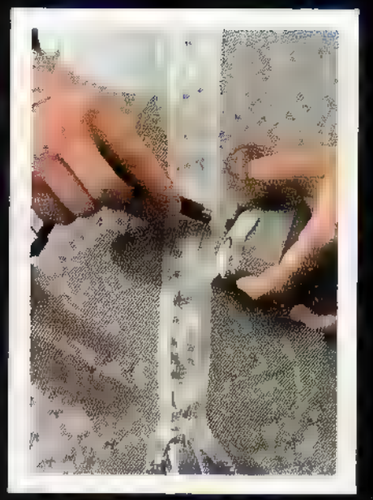
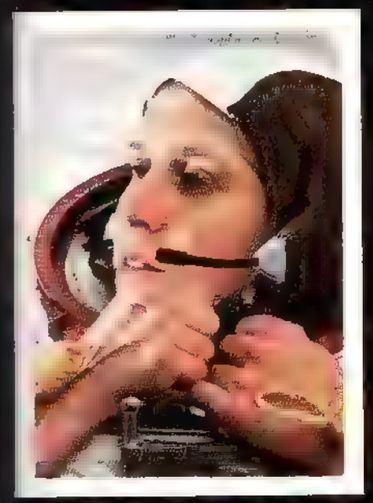
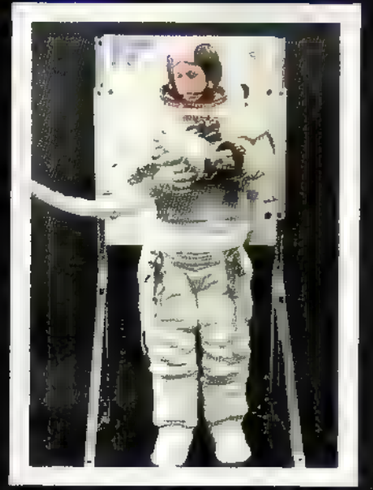








An exclusive first look at what the well-dressed space worker will wear on the job

TAILORED FOR ZERO-G

TEXT AND PHOTOGRAPHS BY ANTHONY WOLFF

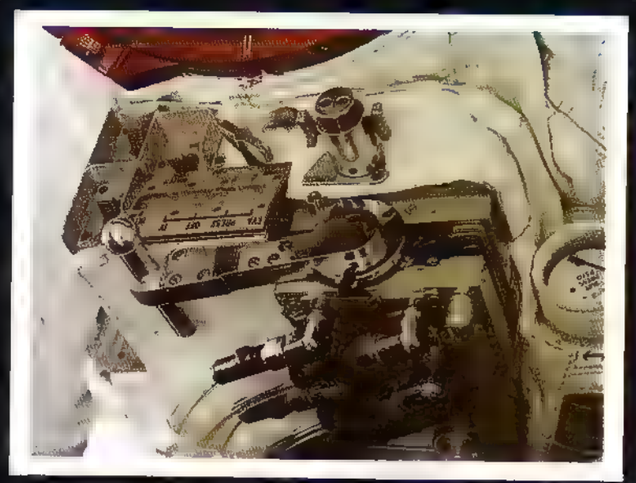
For commuters who will soon ride the space shuttle to work, NASA's extravehicular-mobility unit—EMU, for short—is the latest thing in space coveralls. These photographs, taken at a dress rehearsal of the suiting-up procedure, give *Omni* readers a preview of the EMU in use. Flight-test engineer Jocelyn Johnson models the suit, a product of United Technologies' Hamilton Standard division.

During the flight to orbit, the suit hangs in an air lock between the orbiter's cabin and the cargo bay (top row, left). In the sealed cabin, earthlings enjoy shirt-sleeve weather: The air is a perfect blend of gases; temperature and humidity are controlled; atmospheric pressure is a sea-level 14.7 pounds per square inch.

In preparation for extravehicular activity (EVA), cabin pressure is gradually reduced to 9 psi, drawing nitrogen slowly from body tissues in order to avoid the bends. Johnson puts on nylon-mesh long johns (top row, second from left), slips a radiation dosimeter into an underarm pocket (top right), and plugs in her electrocardiogram (middle row, left). After pulling on her leggings, she squats to get into the upper-torso unit.

Her communications cap (middle row, right) holds a built-in headset and twin microphones. Before locking the suit at the waist, Johnson connects the hoses that circulate oxygen and cooling water from the backpack (bottom row, left). Gloves and helmet are joined to the suit by metal rings. With the suit inflated to 4 psi (bottom right) and pressure in the air lock reduced to zero, Johnson can exit into the cargo bay and float off to work.

"Like the shuttle itself, this brand-new space suit is meant to be used over and over."



Apollo space suits, custom-made and costly, were retired after a single mission; the EMU, like the shuttle itself, can make repeated round trips. Hamilton Standard manufactures the hard-shelled upper torsos in five sizes, including extra-small for women; the soft sleeves and leggings are adjustable. To shield space workers during prolonged EVAs, the EMU has five layers of aluminum-coated film and mesh insulation under its skin of Teflon-coated fiberglass.

Cooled, air-conditioned, and pressurized by the self-contained life-support systems in his backpack, the space worker is independent of the orbiter. The EMU's low internal pressure and soft construction allow him to move freely. With an accessory tool kit, he is armed for a variety of tasks. An armchairlike manned-maneuvering unit, powered by small thrusters, makes him mobile in space. While he works, a microprocessor in the EMU's chest-pack control unit (above) monitors both space suit and space worker, signals if anything is amiss, and displays appropriate printed instructions. The EMU may get its first on-the-job tryout as early as the fourth shuttle mission, now planned for next spring.

Time's up! No peeking at your neighbor's paper

IQ TEST ANSWERS

By Scot Morris

Last month we published an IQ test prepared especially for *Omni* by representatives of Mensa, the high IQ society. Readers were asked to take the 39-item test in 30 minutes. Here are the test answers, along with a few occasional explanations. You can get a sense of which items were easiest and which were hardest from the number in parentheses that follows each answer. It indicates those Mensa members out of a sample of 88 who answered the item correctly.

1. 33. Each increment is double the previous increment. (72)
2. vex, pacify. Although other words have antithetical meanings, these two are considered most nearly opposite. (63)
3. $36. The price is determined by the initial letter of each item and then multiplied by two. $2 for an item beginning with *A*, $4 for one starting with *B*, etc. (45)
4. b. Human things are alternated right and left. Although this item was missed by most Mensans once it was explained there was virtually no argument about the answer. (32)
5. NEWS. The arrows represent North, East, West, and South. (35)
6. 2. In rows, the left number minus the middle number equals the right number. In the columns, the top number minus the middle equals the bottom number. (76)
7. a. The figure rotates counterclockwise by increments increasing one-eighth turn in each successive drawing. The second drawing has rotated one-eighth turn counterclockwise, the third has rotated an additional quarter-turn, the fourth has rotated an additional three-eighths turn. The correct answer, a, shows the figure rotated an additional four-eighths (one half) turn. (37)
8. Discord. (77)
9. Center, perimeter. (73)
10. a. (75)
11. 72. Each succeeding number is alternately multiplied by two or three. (72)
12. a. The black window in the far left column goes down one square each time before it starts again at the top; the black window in the middle goes up one square each time, the black window in the second horizontal row moves left one square each time. (38)
13. c. (72)
14. Beam, ray. (62)
15. d. The center figure is always solid, the symbols in the corners are moving counterclockwise. (65)
16. c. (67)
17. d. The right angle is moving counterclockwise. The changing figure increases the number of its line segments by one in each succeeding square. (64)
18. a. (66)
19. c. (60)
20. a, e. (83)
21. $60. The price of each is determined by the number of letters in the word multiplied by ten. (55)
22. a. The apple and pear alternate black and white and are moving counterclockwise. The two bunches of cherries are moving clockwise. (79)
23. 207. Each succeeding interval is multiplied by three. (50)
24. c. (65)
25. b. The second dot moves clockwise and is hidden in the fourth drawing. (74)
26. d. (52)
27. c. Each increment is multiplied by three. (74)
28. b. (81)
29. Tale, story. (73)
30. c. (59)
31. a. (66)
32. c. This item was the "easiest" on the test. Still, one Mensan missed it. (87)
33. b, e. (83)
34. 6. Each number is reduced by a number that is increased by one with each succeeding term. (85)
35. Curtain, window. (77)
36. York. (41)
37. a. Each square is exactly like its diagonal counterpart, except the color of the triangle changes back to white or white to black. (81)

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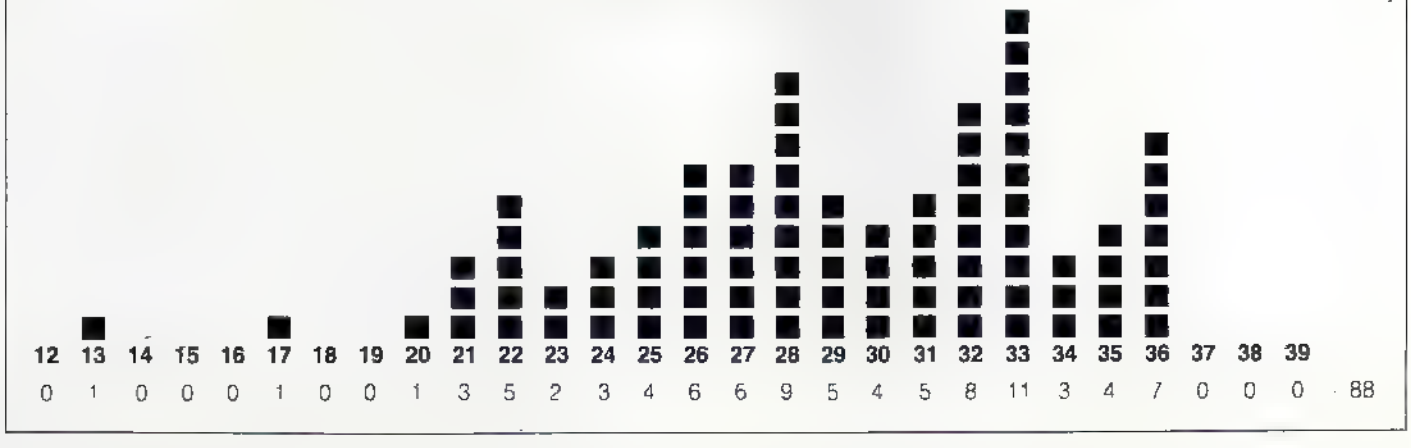

THIS WAY OUT

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had been in touch with Exit shortly before her death in December 1979. A few months later Reed and Exit volunteer worker Mark Lyons were charged in connection with aiding and abetting in Mrs. Crystal's death. Neither Reed nor Lyons has yet pleaded to the charges, but the Exit organization intends to support them fully in court.

Exit's campaign has not gone unchallenged. The British Medical Association and the Samaritans, an English-based group that befriends the deeply troubled, have issued statements questioning euthanasia and condemning the handbook. Samaritans officials Jean Burt rests her case on studies of persons who attempted suicide and failed. 'Eighty percent were glad to be still alive.' She further points out that a suicide attempt may not be meant to end in death but may be a cry for help. Ms. Burt deplores making an Exit-style handbook available to teenagers "whose moods go up and down like yo-yos."

Those objections were put to Sheila Little, seventy-four, who fields tough questions on Exit's behalf. The next decade will see an increase of 43 percent in the number of Britons over eighty-five, Miss Little declared, "but there will not be a parallel increase in the number of caring relatives or facilities looking after them." Increasing numbers of the elderly will therefore prefer to die, and they should be allowed to do so.

As for the handbook, Miss Little emphasizes that it will be available only to members of at least three months' standing. That, she said, will mitigate the problem of having copies fall into the hands of persons who are unstable or temporarily depressed. But what if the handbook is passed around or Xeroxed? 'Our members are responsible people, and we will include in the mailing a very firm statement about how they should keep the material under cover. However, if somebody *steals* a handbook or if a given member turns out not to be very honest, Exit can hardly be held responsible.'

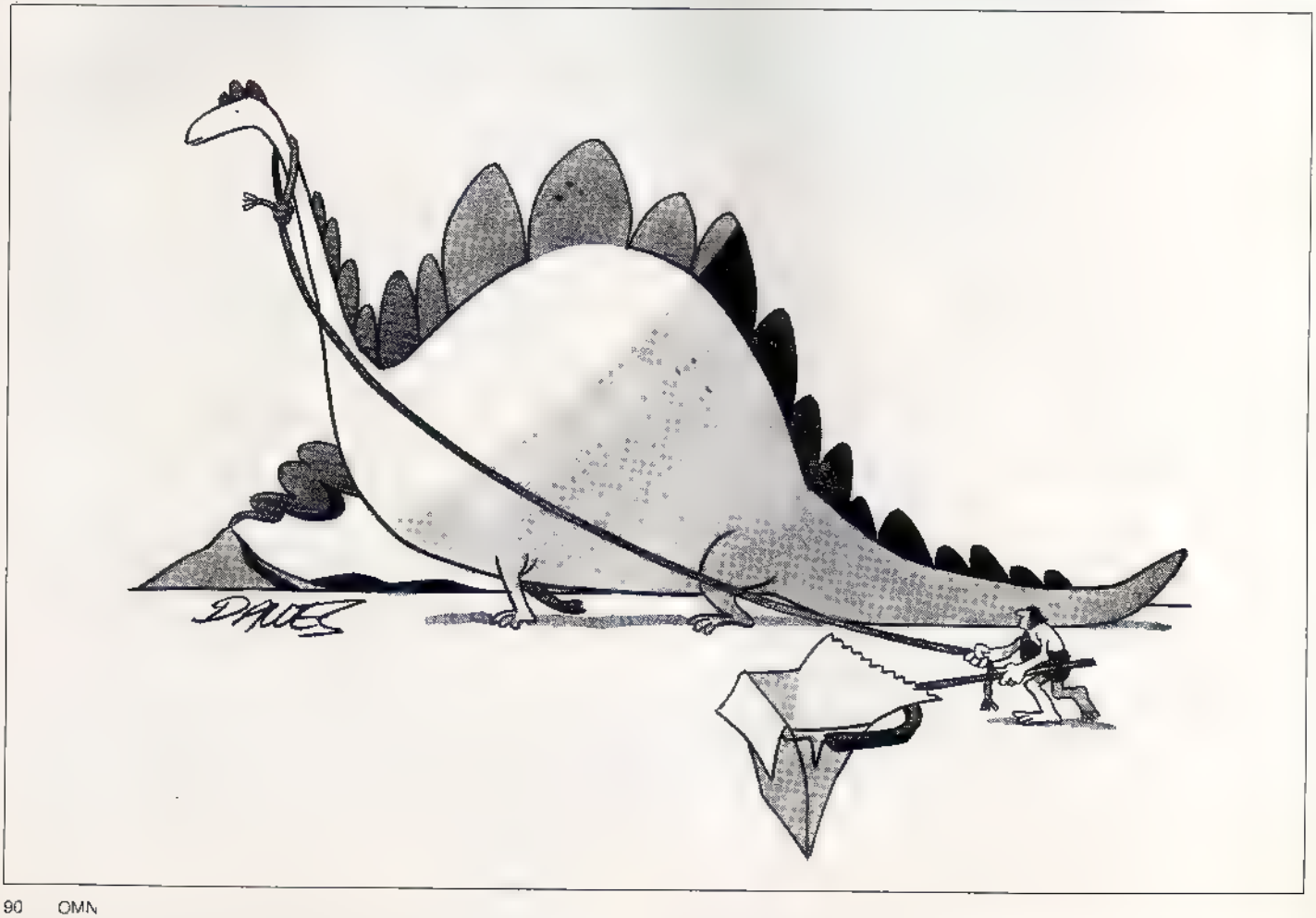
Pressed on that point, Miss Little added: 'There will certainly be one or two unfortunate incidents. But you need to weigh those against the welfare of six thousand or seven thousand elderly people [in Great Britain] dying in pain and suffering a needless prolongation of the dying process.'

Let Me Die Before I Wake. Hemlock's version of the handbook will be 'more human, more moving' than Exit's, Humphry says. It will not be a how to guide but a compilation of people's acts of voluntary euthanasia, told in their words. As such, our lawyers assure us, it will have First Amendment protection. Hemlock, like Exit, will sell handbooks only to members of three months' standing.

Both CFD and SRD decided not to publish anything resembling Exit's handbook. 'Our decision was unanimous and based on two factors,' says Mrs. Levenson, of CFD. 'First, terminating one's life is the most drastic step a person can take, and anything that makes it easier is probably not good. Second, promoting the acceptability of suicide could have a rebound effect on the elderly, with old people feeling themselves 'I have no right to be alive and sick and a burden on others' have a duty to kill myself.' The United States has done a terrible job of caring for its elderly. We don't favor anything that relieves society of its responsibility for improving their lot.'

Humphry readily agrees. Asked whether he thinks that proeuthanasia material should be distributed among the aged, he replies: 'Definitely not. I don't favor even making them aware of the option, because that would imply an obligation on their part to consider it.' Hemlock, he adds, is careful not to proselytize. 'People must hear of us in one way or another and come join. Morally and legally, we feel, that is the necessary approach. It's all right to talk in general terms about voluntary euthanasia or assisted suicide. But it's not all right to say to a person, 'I think you should die. Take forty Seconals.'

SFD meanwhile intends to press nationwide for natural death legislation. Alice Mehling says that the group has encountered two principal objections on the legislative level. One is that a natural death law



will open the door to mercy killing and the other is that there's no need for such a law because doctors are already permitting or practicing voluntary euthanasia. Mrs. Mehling insists that the record since passage of the first act shows no trend toward mercy killing. There hasn't been a bit of litigation under any of the laws and the question of abuse hasn't been seriously raised. As for the laws being unnecessary, not all hospitals are going to honor a living will without legislation behind them. Besides, once a person is connected to a [life-sustaining] machine, it's difficult to have the treatment stopped.

Where will it all lead? To indiscriminate needless suicide? To that and worse, says Malcolm Muggeridge, the English social critic and curmudgeon at large. Ex-Mr. Muggeridge says, represents the trend toward total paganism, toward regarding human beings as merely bodies, animal bodies. If that's all they are, you don't worry about putting them to death. But if you believe men are created by God and have souls, such a choice would not arise.

Muggeridge excoriates Exit's suicide handbook as, completely, the devil's work. If a man consciously and sincerely wants to die, all right, I think he's committing a sin, but people do sin, as we know. In any case, experience shows that people think favorably about euthanasia for themselves when they're well. When they become ill and are actually confronted with death, they wish to remain alive.

Right-to-die advocates dismiss arguments framed in the Muggeridge manner as at best unrealistic. Acceptance of voluntary euthanasia, they say, will bring a dramatic reduction in unnecessary suffering among the dying, as well as a new and healthy respect for a human being's control over his own life. Eighty percent of us are going to die in hospitals, Mrs. Mehling says. None of us know under what circumstances, but we do know that the concept of individual decision making is really gaining greater acceptance.

At least one prominent psychiatrist, the renegade Dr. Thomas Szasz, argues that none of the present right-to-die advocates are going nearly far enough. Dr. Szasz, who believes that although suicide is not necessarily good, it's your right, insists that not only information on lethal drugs but the drugs themselves should be made generally available. He dismisses concern over euthanasia. Suicide is the issue, he says, and it has been given a bum rap. Suicide bears the same relation to murder as masturbation does to rape. It's nobody's business but that of the person who does it. Yet we link suicide and homicide instead of using a sensible term like *self-determined death*.

Few of us, including leading proponents of the right to die, would go all the way with Thomas Szasz. But it's hard to dispute his content on that the issue raises one of the fundamental questions of the contemporary social world. ∞

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CONTINUED FROM PAGE 77

natural state among most mammals because the clitoris doesn't receive sufficient stimulation in the usual intercourse and love play of most mammals, including humans. The clitoris receives little stimulation, since mounting is generally from the rear.

So from an evolutionary standpoint the female orgasm is a luxury. But it's a glorious use of something that we got accidentally, and it makes no more sense to diminish the importance of the female orgasm because biologically, it's an artifact than it does to dismiss the Brandenburg Concertos or Picasso's paintings because they do not enhance our ability to survive.

Omni: Do orgasms in women ever develop on their own as a natural urge?

Kaplan: A little girl can touch herself and discover spontaneously that she can have an orgasm. Artifacts can emerge on their own. Women are endowed with the capacity to feel sexual, to become aroused — and orgasm is extraordinarily important and pleasurable to them.

Omni: Why has natural selection retained the clitoris if it isn't at all necessary?

Kaplan: Why has the appendix survived? Why are we hairless? Why is our sense of smell so poor? We are a very successful species with our high fertility and our magnificent brains. We have the luxury of having many physical characteristics with no survival value. We're like a rich person who can afford unnecessary expenses.

Omni: Let's talk about homosexuality. Does it have a biological basis? Does it result from hormonal differences?

Kaplan: We don't know the answer. Most experts will admit that the data are not all in. Whenever you find a number of different explanations coming from the medical profession, then you know we don't know what we're talking about. Practically speaking, however, with modern methods, many homosexuals can change to a heterosexual orientation if they want to do so.

There are probably several different kinds of homosexuality. Some male homosexuals are anxious and full of conflicts about sex with women. Modern treatment methods are successful at reducing that anxiety, and when they do, very often a man's latent heterosexuality will blossom.

Omni: Why do you think most homosexual men have a large number of sexual partners in a lifetime, whereas most homosexual women do not?

Kaplan: Well, as I said, the male sex drive is much stronger, whether in homosexuals or heterosexuals. Someone with a stronger sex drive will seek more sexual outlets.

Omni: Why can't the homosexual male satisfy his sex drive by male-to-male pair bonding, like heterosexual bonding?

Kaplan: When a male has a tender connection with another male, he's more stable and happier in this intimate relationship. It's just that homosexuals can't always find this. The homosexual male often has a fear of intimacy. Intimacy ruins his sexuality. I think Symons was right about that. If such males start talking to each other and knowing each other, their sexual experience is ruined. But that could be taken as a sign of pathology, not as a true expression of a biological nature.

Omni: Are there differences between male and female homosexuality?

Kaplan: Yes. The male homosexual is moved by a strong erotic attraction to other men, and his heterosexual drive is impaired. The female homosexual is motivated more by anger at males than by a strong erotic drive toward other females. Many, but not all, female homosexuals are so hostile or ambivalent toward males that they are turned off by them. Very often, when they resolve their anger at males and their envy of women who have a man taking care of them, homosexual women are free to feel erotic toward males.

Omni: What are some of the unknowns about human sexuality that you look forward to seeing solved within the next two or three decades?

Kaplan: I think we have come out of the sexual Dark Ages in the last two decades. We finally have some very sensible concepts of sexuality, and we understand and can treat sexual disorders. However, we still don't really understand the brain mechanisms of sexual desire. When we do, we probably have drugs and medication to enhance libido and sexual appetite. Sexual desire resides in the brain. Unless the brain's sexual circuits are active, you don't feel any desire.

Nor do we yet fully understand bonding behavior or romantic attachments. My hope in studying these happy, enduring romantic relationships is to try to answer the question of what our true biological heritage is. There is evidence that our heritage is monogamy, but it may be serial, not lifetime, monogamy. We should know which it is, because the more closely you express your biological heritage, the more content you'll feel. And the closer our diet is to the one we were adapted to, the healthier we'll be and the less stress we'll experience. So it's important to unravel all these mysteries to find out what is closest to our natural heritage. Were we designed for a cold or a warm climate? Were we adapted to be herbivorous, carnivorous, or omnivorous? Is serial monogamy or lifetime bonding our natural heritage? What are the ingredients for successful, enduring relationships between men and women?

I'd like to teach our children the art of wise mate selection. There's such terrible waste when a couple with young children divorce. I'd be happy if the relationship lasted until the children were teenagers. What does it take to choose the right mate and make romantic attachments work? That's my own interest at this point, and I hope we will find some answers soon. ∞

COUNSELOR

CONTINUED FROM PAGE 51

space vehicles should be covered by current insurance law just as air transport is. There's no reason for the government to take on that kind of liability for private companies, he says. "But by signing that treaty, the U.S. government has gratuitously done so."

Dula's list of legal obstacles to space development is a long one. Look at SPS units, for instance. They are technically feasible and might be economically if built in space from lunar materials. Dula himself thinks the tangible benefits of an SPS program could restore public support for space development. Yet at every step there are legal questions to be answered. According to international treaty, space vehicles like ships must be registered to a single nation whose laws govern the craft in space. For an American spacecraft ferrying workmen to build an SPS system, federal law would become space law. But whose regulations would govern a space station owned by a multinational corporation, manned by people from many countries and building SPS units for several different parts of the world? Here the law is not at all clear.

When the first SPS goes into operation, still more legal questions will emerge. Does the power belong to all mankind or to the corporation that collects it? And once the system makes a profit, must the taxes be divided among all governments to ensure a fair distribution of the benefits from outer space? No one knows.

"Existing space law is extremely vague and it is stacked in favor of the Soviet Union and the Third World countries," Dula warns. "This trend must be reversed before a viable commercial space industry can evolve."

Dula has been involved with technical issues from the beginning of his career. As a young patent lawyer with the large Houston firm of Butler, Binion, Rice, Cook, and Knapp, he worked for industrial clients in the medical and aerospace fields. He soon saw the need for a new breed of lawyer, one who could devote himself entirely to the legal questions presented by advanced technology.

Dula first established himself as an expert on the legal aspects of medical physics, then became a faculty member at the University of Texas Medical School and the University of Houston's Bates College of Law. During the same period, he served in the American Bar Association's Science and Technology Section, of which he is now chairman-elect.

After conducting studies for NASA and General Dynamics on the prospects for development of private industry in space, Dula opened his practice in aerospace and technical law in December 1979.

Technologically, Dula claims to be five years ahead of the big law firms. His office is equipped with a modern computer system that tracks his clients' legal activities, his legal papers are turned out on a word processor. His big house is cooled by an advanced heat pump that uses far less energy than ordinary air conditioners.

On the same day that Dula formed his law firm, he became secretary-treasurer and general counsel for Eagle Engineering, a small consulting firm he founded with three engineer-managers formerly with NASA. Eagle applies the technical and managerial skills acquired in the space program to problems encountered in business and government. Eagle has designed petrochemical process equipment, has integrated computer hardware and software systems, and has performed technology assessments of advanced propulsion systems, the SPS, and ocean-thermal energy systems.

Dula is also a charter member of the Space Foundation, a group of Houston businessmen working to find opportunities for free enterprise in space. At the International Aeronautics Association's conference in Tokyo last September, Dula showed *The Harvest*, a film produced by the Space Foundation. The film's thesis is that mankind is no longer limited to a single planet and that free enterprise can use presently existing technology to harvest space resources. It raised a few eyebrows among members of the Socialist delegations, particularly that from the Soviet Union, Dula says.

He also showed slides outlining a technological assessment of the SPS. I think the SPS presentation demonstrated to the Russians that, given the opportunity, free enterprise can operate in space and return real benefits to Earth.

In 1978 Dula ran as a Republican candidate for the Texas House of Representatives. He jokingly remembers his campaign as having been run on the "space platform." In fact, he ran a rather conventional campaign that stressed strong public schools and a comprehensive regional water plan. He lost, but he made a respectable showing in a heavily Democratic congressional district.

One evening during the campaign, he received a last-minute invitation to speak at a community center. Too short of time to prepare a new talk tailored to his audience, he decided to give his slide presentation on the SPS. That audience was the most attentive group I spoke to during the campaign, Dula recalls. "And do you know why? Because space presents us with an optimistic view of the future, a future of growth and prosperity."

Dula has promised his wife, Tamea Ann, who is also an attorney, that they'll visit the moon together by the year 2001. If he isn't a lunar judge by then, he doesn't plan to take more than three weeks of vacation to make the trip.

VOYAGERS

CONTINUED FROM PAGE 55

way to bring them both back home to Earth safely.

Fuck it, Stoner muttered. He reached for his pressure suit hanging limp and lifeless on the opposite wall of the orbital module.

"What you do, Shtoner?" Federenko called from the command module.

"I'm going out." Stoner said, yanking on the pressure suit leggings. This procedure was not a simple matter in zero gravity. "I'll use the backpack maneuvering jets to get to the ship."

"Not enough fuel in backpack. Alien ship too far away."

"Nudge us a little closer then. Close enough for me to reach it."

"No."

"You've got to, Nikolai!"

Federenko appeared at the hatch, his dark face set in a solemn frown. "I want to save our lives, not kill us foolishly."

The exertion of wriggling halfway into the pressure suit made Stoner bob weightlessly across the orbital module. He put a hand against the ceiling to steady himself; his feet dangled a couple of inches from the floor.

"Sit down, Shtoner," Federenko said. "Calm yourself."

"Listen. I could take both backpacks, yours and mine. One to ride me out there, the other to get me back."

"Foolishness."

"But it'd work," he said. "There's enough fuel in the two of them to make it, okay, isn't there?"

Federenko turned away from him.

"Isn't there?" Stoner grabbed him by the shoulders.

"Yes," said the cosmonaut, meeting his eyes. "But, I forbid it."

Stoner went back to struggling into the pressure suit.

"Shtoner, I am in command."

"And I'm a third degree black belt," Stoner retorted, reaching down for his boots. "Are you going to help me, or do we fight?"

"You will kill yourself."

"Nikolai, if we get back to Earth, I'll have to live with myself. Do you think I could, knowing that we got this close and didn't go the rest of the way? That son of a bitch has traveled *light years* to reach us! The least I can do is cover the last hundred meters to meet him."

Federenko said nothing. He solemnly watched as Stoner pulled on his boots and began zipping up the suit.

"Well, are you going to help me, or are you going to just stand there and suck?" Stoner taunted.

Scowling, Federenko pulled his own backpack from its rack and started adjusting its shoulder straps.

"You are killing me also," he said. But he helped Stoner into the backpack.

"What if ground command send up new orders, a new flight path that will get us back?" Federenko grumbled while he checked out Stoner's suit. "You will be out there..."

"I'll be in touch over the suit radio," Stoner said.

"Da. And when I say come back, you will say, Not yet. One more photograph."

Stoner chuckled. Satisfied that the suit was sealed properly, Federenko handed him the helmet. Stoner pulled it on, locked it in place, and slid down the visor and sealed it with care.

"I'll come back when you tell me they've got us a new trajectory that'll get us home," Stoner said, his voice muffled inside the helmet.

Federenko looked unconvinced. He held up one finger, then squeezed back through the hatch into the command module and swung the hatch shut.

Stoner was alone now.

"Radio check," the cosmonaut's voice rumbled in his earphones. "Can you hear me?"

"Loud and clear."

"Very good."

Stoner glided over to the controls that pumped the air out of the orbital module. *Nikolai's giving me his backpack for this,* he thought. *If his rescue depends on going EVA, he's just thrown his life away.*

"Shtoner."

"Yes?"

"Good luck, Shtoner."

"Thanks, Nikolai. I appreciate... everything you've done."

"Say hello to alien for me."

Stoner laughed. "Will."

He cycled the air out of the ovoid chamber and opened the outer hatch. Pushing the extra backpack out ahead of him, Stoner stepped out into nothingness. He drifted free of the *Soyuz*, then turned and surveyed the situation.

The earth was far away. No longer a huge smear of awesome girth, it was now a blue and white crescent hanging in the star-scattered dark. He could see the moon, too, a smaller crescent. The sun's fierce blaze was over his left shoulder; he had no intention of looking in that direction, but he could see at the corner of his vision the glowing disk of the sun's zodiacal light, cosmic dust rubble left over from the formation of the planets eons ago.

A slight, soundless puff from the thrusters at his waist and he squarely faced the alien spacecraft. It floated serene and aloof inside its golden, pulsing aura of energy.

Slowly, tugging the spare backpack on its tether, Stoner approached the alien spacecraft.

"Nikolai, do you suppose that energy screen could do damage to a slow-moving object like an astronaut?"

"Could be." Federenko's voice responded. "Keep talking; everything is relayed to home base automatically."

"Okay."

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Describing what he was doing as he did it, Stoner pulled up the tether that held the extra backpack, reeled it up until the pack was in his grasp, then pushed it out ahead of him. The effort slowed his approach to the alien spacecraft as the backpack sailed out ahead of him, the long tether gradually slowly unwinding.

"The tether's insulated," he said. "If the screen causes an electrical discharge, it won't run back up the line and zap me, I hope."

He held his breath as the backpack glided into the glow of energy, then passed through it with no discernible effect.

"Did you see that, Nikolai?"

"Nothing happened."

"Right. Good." Stoner licked his lips. "Now it's my turn."

"Cameras are recording. Television transmission is working."

Stoner touched the controls at his belt and felt the thrusters push against the small of his back, gently, for just a flash of a second. He glided toward the light.

"Almost there."

The glow seemed to be all around him for a moment. There was a brief sharp *crack* in his earphones, and then he was clearly inside the screen. He twisted around for a view of *Soyuz*.

"I'm through it! Can you hear me?"

"*Da*."

"It's like being inside a gold-tinted observation dome. I can see through it. Doesn't obscure my vision much."

"I see you also," Federenko's radio voice was as strong as ever, although a slight background hum now accompanied it.

Stoner could feel his heart pumping. "Okay," he said. "I'm going to . . . going aboard it."

"Be careful, Shtoner."

The extra backpack, still drifting at the end of its tether, bumped into the curved side of the spacecraft and bounced harmlessly off it.

"It's cylindrical," Stoner reported into his radio microphone, "with tapered ends. Sort of like a fat cigar. Light tan in color. Looks like metal. No protuberances, no antennas that I can see. Very smooth finish. About twenty, twenty-five meters long, five or six deep."

He was close. The craft loomed before him, dominating his vision. His lips felt dry. His innards burned.

"Kind of light brown in color . . . I said that already, didn't I? Looks like metal. Definitely metal. Well machined. No sign of rivets. No seams. Like it was made whole, cast out of a mold or something. No markings. Hasn't been pitted *at all* — like it's brand-new. That screen must eat up micrometeoroids and any other junk it encounters . . ."

When he reached the curving side of the massive spaceship, Stoner instinctively put out his hand. He touched it, rebounded slightly, and with his other hand pulsed the thrusters, which gently pushed him up against the craft's hull once again.

"Yeah, it's got to be metal. Feels like metal."

He planted his boots against the ship's hull. They clung.

"Hey! I think it's magnetized! My boots are sticking to it." Stoner pulled one boot free. It took only a slight effort.

"Boots are nonmagnetic," Federenko said flatly.

"Well, something's holding them," Stoner answered.

He stood erect on the curving hull, a lone visitor on a world twenty-five meters long. He took one step, then another. It felt tacky, as if he were walking across a freshly painted surface that hadn't quite dried.

"Going forward," he said. "At least I think it's forward. Could be aft. This thing looks the same at both ends."

Carefully Stoner planted one booted foot in front of the other.

And felt the breath rush out of him.

A line of light suddenly glowed the length of the ship and his earphones gave out a low frequency whining hum. Not loud enough to hurt, just loud enough to make certain that it could not be ignored.

The line of light flickered through every color of the spectrum. It was like watching a rainbow rippling under a stream of water.

"It's color!" Stoner shouted, describing it. "Then it goes dark . . . I think it goes into the infrared and ultraviolet, beyond human vision."

The whining in his earphones also wavered up and down in pitch, and Stoner realized that he could hear it only during the few seconds of time when the line of light was off.

"It's going through the whole electromagnetic spectrum. Visible light, radio frequencies . . . must be putting out pulses of X rays and gamma rays, too. Can you hear me, Nikolai?"

The cosmonaut's voice came through despite the background noise . . . hear you. The high energy detectors on instrument panel are silent.

Stoner watched the flickering light, fascinated, almost hypnotized. It's saying, "Welcome aboard," in all the colors of the rainbow.

Federenko's unruffled voice replied, "Switch to radio frequency two. Perhaps hum is not there."

They went through all four channels on the suit radio. The whine persisted on all of them, running up and down the scale in contrapuntal rhythm with the line of light.

"Hold everything," Stoner yelled. "It's something."

Up at the nose of the craft the line of flickering light suddenly split into two parallel lines, then looped around to form a circle. The metal of the hull inside the circle seemed to brighten.

"Something up at the nose," Stoner described the circle. "Maybe it's a hatch."

"Be careful, Shtoner."

"I'm going up there."

Trembling, throat dry, too excited to be

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afraid, Stoner stepped slowly toward the glowing circle.

He stood at its edge as the whine in his earphones worked its way up to a shrill screech and then cut off completely. The line of light cut off, too. But the circle of metal continued to glow dully, almost as if heated from within.

"It's glowing," Stoner reported. "Could it be radioactive? A nuclear heat source? Maybe I've cooked myself."

"No radiation counts from detectors here," Federenko told him.

"Maybe the screen blocks it."

Federenko said nothing.

But the glow was subsiding now, and Stoner saw that the metal inside the circle was becoming milky translucent. He strained his eyes looking at it.

"I think I can see something."

Slowly he got down on his hands and knees and put the visor of his helmet against the hazy surface.

"It's clearing up. It's becoming transparent. I can see inside... not much light down there, but..."

He peered through the glassy surface, forcing himself with sheer willpower to see what was inside. Then it hit him with the power of a physical blow.

"Oh, my God in heaven," he whispered. "It's a sarcophagus."

"I can see right through the metal," Stoner said into his helmet microphone. "The metal's become transparent."

"He's dead?" Federenko asked.

"Must be. Or frozen. Maybe he's just preserved... you know, cryonically."

Stoner's pulse was racing, and he felt sweat trickling along his skin inside the pressure suit. It was difficult to make out details of the alien's form. He was a long, very solid-looking body stretched out on a bed or bier of some sort. There was a head, shoulders, two arms. He couldn't see the lower part of the body.

"Speak!" Federenko commanded. "What do you see? Your words go straight to base."

"Okay, okay."

Stoner pressed his visor close to the transparent hatch again, to get a clearer view. And there was no hatch. His helmeted head sank an inch or two below the rim of metal that framed the circular hatch.

"Oh, no." He pulled back, then ran his gloved fingers around the rim of the circle. It was open, as if the metal that had been there moments earlier had dissolved.

"Nikolai," he called, fighting to keep his voice from climbing too high. "The hatch first it went transparent, now it's disappeared altogether."

"Disappeared?"

"Gone. Vanished. Just an open hole where solid metal was a minute and a half ago."

Federenko asked unbelievingly, "It is open?"

"Yes. I'm going inside."

"Wait. I check with ground control first."

Stoner shook his head inside the fishbowl helmet. At their distance from Earth it was taking nearly six seconds for Federenko's messages to reach base and another six for their responses to get back to *Soyuz. Plus the time in between while they screw around trying to make up their minds,* Stoner thought.

"I'm going in," he said.

"Wait, Shtoner."

But Stoner already had his hands on the hatch's rim and started gingerly lowering his legs through the opening.

"I'm halfway through. No problem."

"Shtoner, it could be dangerous."

"I don't think so."

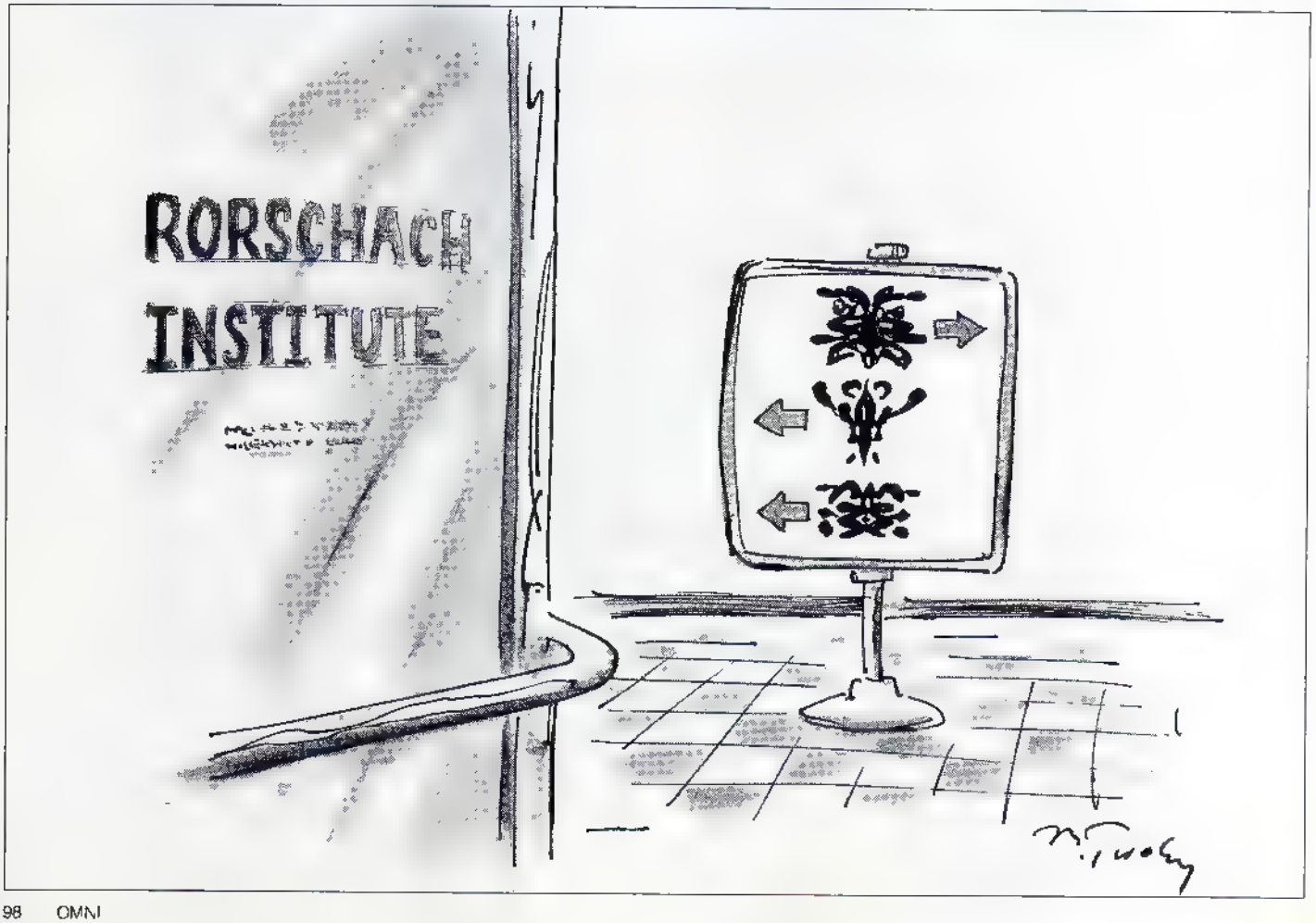
He floated down inside the craft and touched his boots to the soft flooring. They stuck gently, just as they had on the outside of the hull.

He turned slowly in a full circle, taking in the interior of the alien spacecraft.

"I'm inside," he said, his voice unconsciously hushed. "Can you hear me?"

"I hear you." Federenko's voice in his earphones was weaker, streaked with sizzling static, but clear enough to understand easily.

"It's a lot smaller in here than the ship's exterior dimensions. This must be just one compartment. All the machinery's hidden behind bulkheads." He shivered. "And it's *cold* in here. Colder than outside. How can that be?"



"What do you see?"

Stoner turned to the elevated bier and the creature resting on it. He took a step toward it, then stopped.

The curved walls of the compartment were starting to glow. Not like molten metal but like the soft radiance of a moonlit sky. As Stoner watched, slack-jawed, the hull turned milky-white, then translucent, and finally as clear as glass.

"Shtoner! Answer! Federenko was bellowing. "Can you hear me?"

"I can see you, Nikolai," he answered, awed. "The whole damned hull has turned transparent, just like the hatch did. I can see right through it."

A pause. Then Federenko grumbled, "It is the same as always from here. Dark metal. Not transparent."

"A one-way window," Stoner mused. "Christ, what'd that be worth to Corning?"

"Who?"

As he stood beside the bier and looked across the hundred or so meters of vacuum to *Soyuz*, Stoner giggled. It looked squat and ugly to him now, a primitive artifact from a primitive world.

"They have one hell of a grasp on materials sciences, I'll say that for them."

"Describe Shtoner. All is being transmitted to base."

He swallowed hard and looked down at his gloved hands. They were trembling.

"Shtoner, talk."

"This whole section of the interior is about eight meters long, say twenty-five feet. Almost the full five meters wide, but only two and a half, three meters high. The floor is solid and opaque. So is the back wall of the compartment. But the nose and side walls are perfectly transparent. As if there weren't any hull there at all. I can see right through it."

He stepped to the edge of the floor and put his hand out tentatively. The gloved fingers touched the invisible hull. It felt spongy, giving.

"Hull's still there, though. Hasn't vanished completely, the way the hatch did. And it's very cold in here, as if energy can go out through the hull, but none can get into it."

Turning back to the alien, Stoner took a long look in the dim starlight. Then he remembered the lamp hooked to his belt and turned it on.

He leaned over the alien's body. It was very long, but extremely thin, emaciated, desiccated.

"He's more than two meters tall, I'd say. No clothing. Very skimpy, plenty of ribs showing. Body's covered with some kind of orange-brown fuzz. Not hair, really. Looks more like a nap on velvet. Almost."

"The figure is human?" Federenko asked.

"Sort of. Two arms, one head. Torso's much longer than ours. Legs start where our knees would be. And there are four of 'em, four legs. Little knobby ones with round hoof-like pads at the ends."

"Wait..." Federenko said. "Base re-

ports your words being broadcast across Soviet Union, Europe, America, Asia, many other places."

"I'm on live, Nikolai, in Russia?"

Federenko hesitated, then replied, "In USSR, broadcast is delayed fifteen minutes, so censors can make certain nothing harmful is let out."

"And in the States?"

"Live. I think."

"I'd better watch my language."

Federenko said nothing.

Stoner turned back to the alien. "Arms are longer than ours. The hands have only two fingers each, and the ends of the fingers look like suction cups, suckers, like on an octopus."

"The head? The face?"

"Seems to have two eyes, but they're closed. I don't see a nose of any sort, but there's a mouth, lips at least. Wide and thin." Stoner couldn't bring himself to touch the creature, although he badly wanted to see what was behind those lips, those closed eyelids. Same kind of nappy fur covers the whole face, even the eyelids. The head is rounded, large, domed, and very smooth. "I don't see what he could have breathed with."

"Is it breathing?"

"No." Stoner said. "He's dead. I can *feel* it. There's no atmosphere in here. This chamber's been in vacuum for millennia. It's cold, too. Frost is beginning to form on my visor."

Turning up suit heater.

"Right. I'm doing that." The miniaturized fan in the helmet's collar hummed a bit louder.

As the tendrils of frost cleared from the edges of his visor, Stoner saw that there was writing on the bier alongside the alien's body. And artifacts: a metal cup, a translucent sphere the size of a child's ball, a rod of something that looked like wood. He tried to pick up the rod, but it stuck fast to the surface of the bier. As he described it all into his microphone, he tried to dislodge the other objects. None of them would move.

"This is a sarcophagus, Nikolai. A tomb. I know it. This guy died a million years ago and had his body sent into space—like an Egyptian pharaoh. He had himself sent out in a sarcophagus."

"But why?"

As an *ambassador!* The answer hit Stoner's conscious mind as he pronounced the words. Of course! As an ambassador. What better way to make contact with unknown intelligent races scattered across many thousands of light-years? That's it.

Ambassador?

Yes! Stoner knew he was right. "He's saying to us, 'Here I want you to see me, to know that I exist, my civilization exists. You aren't alone in the universe. Take my body. Study it, study the artifacts I've brought along with me. Study my ship. Learn from

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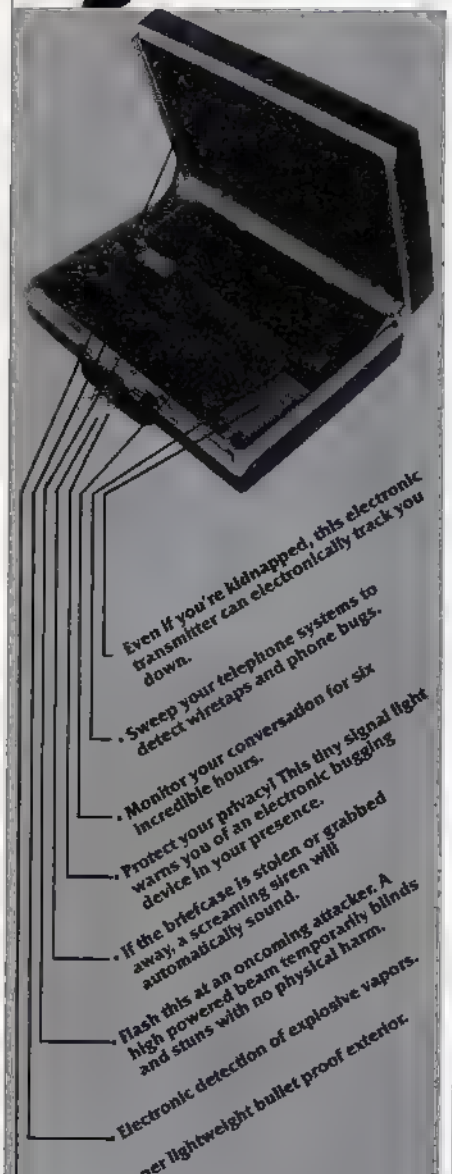

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me.' What better way to share knowledge? To show that his intent is totally peaceful, benign?

Federenko was silent, thinking.

Stoner went back to his description. 'He's got a jaw that looks like it hinges the same way our own jaws do. No ears, but there are a couple of circular patches on the sides of his head. They look almost like outcroppings of bone. They're not horns, though. They're flat. Perhaps sense organs of some kind.'

'What sexual organs?' Federenko asked. Then he added, "Biologists want to know.'

Stoner grinned. 'They would. Nothing visible in the usual place, but there's some kind of protuberance halfway down his torso. And his fuzz is a slightly different color around there, more yellowish.'

"Wait," Federenko said. "We are getting a transmission from ground control."

Stoner walked around the raised platform, bobbing in the zero gravity as his boots clung slightly to the spongy flooring. There were more artifacts on the alien's other side. A straightedge, a square covered with dots that were connected by thin lines. *An astronomical map?* he wondered. *This ark is a damned treasure house. It looks like he's brought his whole civilization with him.*

Federenko's voice interrupted his musings. 'Switch to frequency two, Shtoner."

Stoner clicked the suit-radio switch on his wrist, and the Russian's voice said, "Shtoner, this frequency is for private talk. Not for broadcast."

'Okay.'

'Ground command is working out new course for us, to get us back. New tanker is being launched.'

'I knew they'd figure something out,' Stoner said.

"We will fire retro rockets to break present course very soon."

A tingle of alarm went through Stoner. 'How soon?"

'Computers working on it. But you must be ready to return to *Soyuz* when I give command.'

"Sure," Stoner replied.

'Photograph everything now,' Federenko said. "Time is short."

"Yeah, okay. I'm switching back to frequency one now. I want everybody to hear what I've got to say.'

Federenko grunted. 'Base estimates more than one billion people hear your voice.'

Good, Stoner thought. *Now they'll know.*

Unhooking the bulky thirty-five millimeter stereo camera from its case at his belt, Stoner said for broadcast, "I think it's clear now that this alien has come in peace. He's offering us his body and his treasured possessions, giving them to us for us to study. He's telling us that we have nothing to fear, that there are other intelligent races scattered among the stars. We're not alone. The universe is filled with life, and it's civilized, intelligent life."

He was starting to babble, and he knew it, but his hands clicked away with the camera while he chattered on. 'We have nothing to fear! This isn't the end of our world. It's just the beginning! Do you realize what that means? Intelligent civilizations *don't* wipe themselves out with wars or pollution or overpopulation—not always, not inevitably. We have a future ahead of us as wide and bright as the stars themselves, if we strive for it, if we work together, all of us—the whole human race as a species, as one family unit in the great interstellar community of intelligent civilizations.

'No sign of other life forms here,' Stoner continued, his throat rasping. 'No plants or seeds or other animals. Maybe they're in one of the other compartments of the spacecraft.

"I've tried to get into the rest of the ship, but it's no go. Just a smooth blank wall that won't open up. It's going to take a lot of study to figure out how they work their entrances and exits.

'The biggest discovery among the artifacts, I think, is this star chart. At least, I think it's a star chart. I don't recognize any of the constellations, but there's writing on it. It looks like writing, a lot of circles and curlicues.'

Federenko's heavy voice broke in. 'Shtoner, we have new trajectory data. Tanker is being sent to meet us. We must retrofire in eleven minutes.'

Eleven minutes? Stoner's heart stopped in his chest. His voice nearly cracked. 'Ten minutes, forty-eight seconds, to be exact.'

Stoner's gaze flashed to the alien resting on his bier. *He's spent thousands of years to get here, and I have to leave in ten fucking minutes?*

'No,' he protested. 'We need more time. We can't—'

'No more time,' Federenko said flatly. 'Come back to *Soyuz* now. There's no other way.'

'Nikolai, I can't! Not yet!'

'Now, Shtoner.'

Stoner looked through the transparent hull of the sarcophagus toward the distant stars. Then at the shrunken Earth, so far away, and finally at the stubby *Soyuz* waiting for him.

'Nikolai, please—'

'We must go, Shtoner. Order here.'

Stoner's lips were dry and cracked. He felt the chill of death breathe on him, and he turned to stare once again at the alien. *All the distance you've come, to offer us your body, your knowledge, everything that you are and that you represent. So much to learn from you.*

'Shtoner!'

'No,' he said quietly. 'I'm not going back with you, Nikolai.'

'Shtoner—'

'I'm going to stay here, with him. Maybe in another few million years some other civilization will find the two of us.'

And he turned off his suit radio. ∞

COMMUNICATIONS

CONTINUED FROM PAGE 10

while cost estimates available last year actually show a $70 billion price tag.

The Air Force has chosen to place this system in an area not likely to generate public inquiry. Utah and Nevada lack the population and thus the political clout to influence the Department of Defense. This fact coupled with the vast tracts of federally owned land (nearly 90 percent of Nevada) will ensure the deployment of this technologically obsolete system.

Spinrad's thrust seems to be one of satire, however with more extensive research he might not have found the facts so funny.

Mark Meiser
Reno, Nev.

Solar Sisters and Brothers

Interested as I was in solar energy, I was angered by Patricia Seremet's report on the Women in Solar Energy's conference held at the University of Massachusetts at Amherst [Earth, Apr. 1981].

The issue at hand is solar power, not sexual power. We need knowledge and experience from men and women alike collectively increasing our understanding of the subject.

Kenneth B. Sherman
South Berwin, Mass.

Ecofighters

One letter in Communications [May 1981] has me hopping mad.

Living in the decaying suburbs of Indianapolis, apparently I can appreciate better than Tony Nijhuis of Nelson, British Columbia, Canada, what wilderness and wildlife are left on this planet. The wildest thing I've seen around here is a fat skunk on the interstate highway.

The phrase *managed harvest* is a euphemism for government-sponsored slaughter. I hear that the Canadian government officially admitted recently that many baby seals were being skinned alive. As for this harvest's lasting for hundreds of years, so did slavery. Duration is not a just grounds for continuation.

The excuse that seals and man compete on any significant scale for fish is a transparent ruse, much like the rationalizations trappers use. If the Grand Banks fishermen are having trouble finding fish, it's probably from overfishing. But I suppose it's easier to blame it on the seals.

Trappers and seal hunters do not survive in the wilderness; they survive off it parasitically. Being fit in the context of the environment means being able to live in harmony with it; it does not mean destroying or wasting its resources on frivolous fads. Will the vogue in 100 years be house cat coats?

Susan Ruthroff
Indianapolis, Ind.

In response to the letter by Tony Nijhuis regarding "Ecofighters" [Earth, February 1981]: It is an unfortunate fact that the seal hunt as a managed harvest has been going on for hundreds of years, but we find it grossly irrelevant when the numerous inhumane acts of mankind over the past millennium are taken into account. Time has never condoned iniquity.

Nijhuis also states that most ecologists are city dwellers and therefore lack understanding of survival in the wilderness. He cannot conclude from this that ecoactivists' concerns are illegitimate.

Karen and Becky Mendenhall
Evans Coop

Phenomenal Photo

Paul D. Lewis snapped a superlative photograph of the clouds crossing Ohio's night sky [Phenomena, May 1981]. I tried Jerry Andrus's spiral hypnodisc and it really did create a swirling boiling image.

Sherri Patterson
Akron, Ohio

Media's Uncommon Sense

It might be said that Jeff Rovin's analysis of antinuclear cults is a mite florid [Earth, November 1980]. However, Cynthia Albert's February rebuttal is illustrative of the hyperbole that characterizes the output of these well-informed practical people.

My file of nuclear-related news items includes numerous accounts of antinuclear activities. Thus far the no-nuke movement has demonstrated very little to warrant its glowing self-analyses. Ms. Albert's opinion is not shared by objective observers.

My conclusion is that the media are peculiarly averse to the positive aspects of nuclear power, preferring to present an almost exclusively negative viewpoint. If nuclear power is to be a viable contributor to our energy scenario, the media should present a balanced mixture of information.

Since it isn't common sense to burn a forest to boil a pan of water, it is ironic that the antinuclearists' alternative is to "Split wood, not atoms."

Bob Renaud
Pittsfield, Mass.

Intelligent Alien

I enjoyed reading Robert Forward's article "Alien in our Seas" [May 1981]. I've often heard that octopuses are intelligent, but I never knew that there was any evidence to substantiate such intelligence. The idea that the seabound octopus is headed for a dead end did puzzle me.

On a planet whose surface is 70 percent water, living in a wet environment hardly seems like a handicap! The seas provide a three-dimensional living space free of climatic extremes (drought and flooding) and food is abundant. Water, in many ways, is a hospitable habitat.

The octopus is not limited by its girls, nor are we limited by our lungs. Life fills all niches, and intelligence is not restricted to just one species or one environment.

Linda Palter
Stapleton, N.Y. ∞

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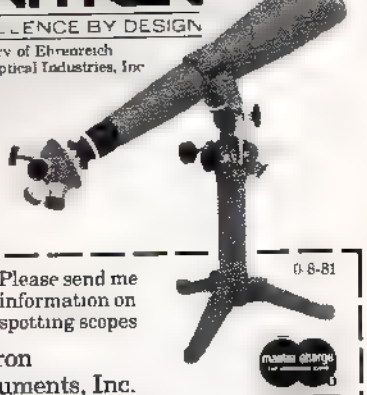

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Skip across the ocean on a **Surf-Jet**. With a centrifugal water-jet pump providing 110 lbs. of thrust, you can careen over seas at 30 mph. A hydraulic throttle cable (the long cable with the red handle in the photo) shuts off the engine automatically and controls speed. The Surf-Jet, priced at $1995, will carry 400 lbs. of rider. Contact Hammacher Schlemmer, 145 East Fifty-seventh Street, New York, NY 10022.

Spy on the heavens with the **Criterion Dynamax 4 telescope** (on Surf Jet, top), an intelligently priced optical marvel for the explorer astronomer. This telescope can focus down to 15 feet or up to Saturn's rings. The 9.5 lb. portable observatory has a Schmidt-Cassegrain optical system. The telescope's greatest asset, its price, $1,500 less than comparable telescopes. The manufacturer has announced a special deal exclusively for *Omni* readers: a $100 discount on the retail price of $499. By September 1, write to the Criterion Telescope Company, Department 'Omni,' 620 Oakwood Avenue, West Hartford, CT 06110.

Go solar with the **Atlantis Solar Flask** (below telescope), a thermos with reflectors. It cooks most foods quickly and it keeps liquids cool. The cap contains a thermometer and pressure relief valve. The flask is available for $99.95, from Atlantis Solar Applications, PO Box 1813, North Brunswick, NJ 08902.

Directly below the flask is the **KLH Solo headset**. This FM radio/cassette player is among the best of new personal stereos. A pop-in FM cassette module and dual flywheel drive make this an excellent unit for joggernauts. The lightweight Solo, at $229.95, is available from KLH Research and Development Corporation, 7945 Deering Avenue, Canoga Park, CA 91304.

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Propped up against the solar radio is a light-powered **LCD calculator** for $42.25 from Edmund Scientific Company. Since it operates on power from any light — even a match — this calculator never needs batteries and never quits. Write to the Edmund Scientific Company, 7082 Edscorp Building, Barrington, NJ 08007.

Scuba diving enthusiasts can talk to companions via the underwater **Sport Phone**. This ultrasonic communications system, priced at $249, transmits and receives for up to 100 yds. with remarkable clarity. For more information write to Sound-Wave Systems, Inc., 3001 Red Hill Avenue, Costa Mesa, CA 92626.

The huge silver spiral to the right of the Surf Jet is a **Curly Cooker**. For do-it-yourselfers, this solar concentrator is made by slightly coiling a spiral strip of reflective material and gluing it to cardboard or wood. Then it's mounted on a frame that angles the Curly for the desired focusing strength. These cookers can be engineered to perform like a multiburner stove by providing several focal points at once. Do-it-yourself Curly patterns are available, for $6, from The Suntwist Company, P.O. Box 342, Stone Mountain, GA 30086.

Happy trails!

BY GEOFFREY GOLSON

PHOTOGRAPH BY MICHAEL SOMOROFF

REVOLUTION

CONTINUED FROM PAGE 65

It may have been slow, but I was fascinated. Oliver's a skilful engineer and OGRE was functioning smoothly as far as I could tell. Already a kind of chassis had been assembled, and as it began to descend the helix, it acquired extra parts.

The junk metal dropping into the hopper did kick up a bit of a racket, though.

I rearranged a few my work schedules to keep me in the Bristol area for the next few days, but my mind was only half on the job. Every spare moment I spent over in Menderby seeing how OGRE was progressing. And the more I watched it, the more the clanking of metallic scrap came to resemble the cheerful chinking of coins. It really looked as if Oliver had tapped the mother lode this time.

On the evening of the third day a miniature OGRE about a foot long duly rolled off the ramp at the end of the assembly line. It whirred across the floor and began to rummage happily around in one of the smaller bins. Within a quarter of an hour a sub-sub-OGRE had begun its spiral descent.

Suddenly I truly believed, not just an intellectual acceptance, but a warm glow in the gut. It was overwhelming. My God, Oliver! Look at that thing! It's building *inch-long robots*."

If you think *that's* astonishing, wait a few generations more. You'll need a microscope to see anything at all."

We stared at it. Motherhood must be something like this. The tiny scraps of junk metal went tinkle-tinkle-tinkle." Oliver had a sloppy smile on his face. "Oh, look. I said, it's *feeding*." We looked at each other, and we both burst out laughing.

"You'll be checking it for colic next," he said. "Wake up, man, it's just a machine! I've got a better idea than just standing around here!"

"Oh?"

"The Carpenter's Arms at Portishead. Prawn cocktails and jugged hare."

"Mmm. Sautéed potatoes, asparagus tips, and sour cream!"

"Black cherries in Kirsch!"

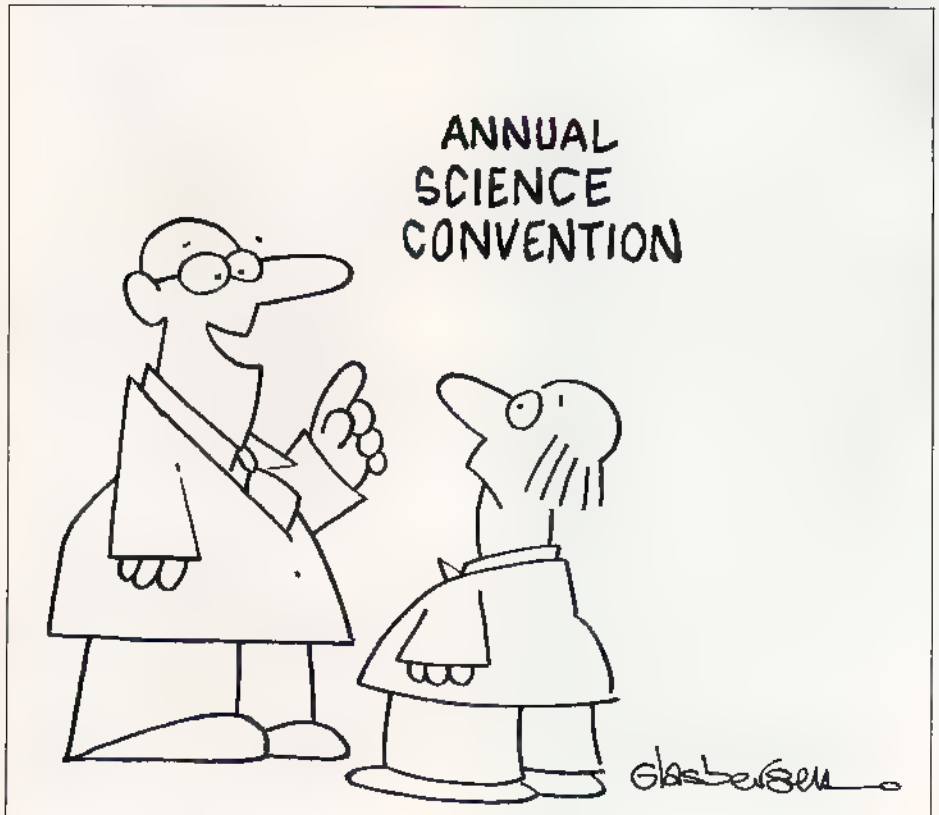
"Champagne!"

We left hurriedly.

We arrived home in a taxi well after midnight, as plastered as the ceiling of the Sistine Chapel. We didn't look into the basement at Decal Labs until midmorning the next day, when Oliver drove us over.

OGRE was a total wreck.

At first we thought that someone had vandalized it. Then I suggested to Oliver that it had perhaps fallen to bits of its own accord, and he lost his temper. Only when he felt something scamper up his leg did he stop shouting at me. He thought it was a spider, and he hates spiders.



"It's a fact that people will eat hotdogs no matter what you put in them. Which brings me to my idea for disposing of nuclear waste."

It was a fourth-generation OGRE about a tenth of an inch across.

It seemed to be trying to eat his belt buckle.

"Oliver," I said, "what's that funny *rasping* noise?" We listened. Besides the rasping there were faint clanks and clicks and hums, and behind them all a persistent background whine, like a tethered swarm of mosquitoes.

"It's coming from OGRE," he said. He bent down to take a closer look. "Get me a magnifying glass!"

"Where?"

"Look in the filing cabinet under M." I found it and passed it to him. He hitched up his trousers, squatted on his haunches and peered through it at the wreckage. I have seldom seen anything looking less like Sherlock Holmes.

"Oh, my God!" he said. "Look! Look!"

The OGRE matriarch was crawling with sub-sub-sub-etcetera-OGREs, like a rotten cheese afflicted with mites. They were dismantling it. Cockroach-sized OGRElets were hacking Mama to pieces with teeny-weeny chain saws, on retractable arms, gouging chunks out of her plating with their little laser cutters and stripping the insulating plastic off her wiring to melt it down for their own use. And as they pursued their gruesome task, even tinier OGREts swarmed over *them*, sawing and rasping and hacking so fast that all you could see was a blur. The larger OGREs were trying frantically to repair themselves, and I saw several of them sweeping up piles of the smaller ones with devices resembling dustpans and pouring them into their own hoppers. It wasn't doing them much good. The little OGREs were eating the hoppers faster than the big ones could digest them.

It was a jungle in there.

It looked as if nothing could possibly survive. But the smaller OGREs reproduced so much faster that they had a considerable advantage. Their numbers were obviously increasing.

I handed the magnifying glass back. Its metal arm was dull and pitted. They'd started on that.

"I don't understand," said Oliver. "There ought to be only *one* machine in each generation. I wonder whether—" Suddenly he thrust his hand into the wreckage and began groping around. "It should be—gerrroffff! Yes, here it is." He extracted a magnetic card, mostly intact although it looked as if mice had been at it around the edges. "They don't need much plastic, fortunately," he said. He shoved the card into his terminal and switched on.

There was a shower of sparks, and the terminal collapsed. They'd started to scavenge that, too.

There were many more terminals in the Decal labs, and we tried one three floors up. It worked. Presumably the OGREs hadn't yet moved that far afield. Oliver ran through the program listings and soon found his mistake. "Damn! I misspunched

the card for OGRE s fert ty factor '

"Wh ch does what?"

'Contro s the rat o of numbers in suc- cessive generations It should have been set at 1 to keep just one mach ne at each stage I seem to have put an extra zero on the end

You oon

Wel it was only a *little* m stake

'Surely But as a result we get *ten times as many* OGREs at each stage?'

Yes

O ver you've got a popu ation exp o sion on your hands Lord knows how much damage these things wil do!

Now don t get upset t isn t as bad as you th nk I put n a stop code at mac romo ecular s ze remember? Once they reach that generat on they stop reproduc ing and sw tch off They die out The dam age area shou dn t be too b g

"Oh Wa t a m nute though Shouldn t we have reached that stage by now? What s the formu a for summing a geometr c pro gression?'

You ve forgotten foraging time That s a l mit ng factor and it s random t will s ow them down a b t We just have to wa t

We wa ted We made occasional forays down the sta rs The act vity cont nued un abated n fact t seemed to grow Finally suggested we take another look at the pro- gram

Oliver had been using a h gh-eve lan guage that accepts commands n Ang ish Analog-Engl sh and instead of tell ng t to stop *reproducing*, he d to d it to stop *reducing*

You know what you ve bu t?" said He groaned

A rapid breed ng artf cia virus One that *eats meta*

Our f rst thought was to call the po ce but the phone didn t work None of the phones worked The interna te ephone ex- change was n the basement

The car wouldn t start not surpr singly for someth ng that looks like St ton cheese So we departed on foot It was ra n ng n torrents

Ha f a m e down the road the so e of my left shoe fe off They d eaten the nai s O ver was having trouble w th his zip

This is terrib e! exc aimed

Too r ght! It hasn t ra ned l ke this since

'I mean your bloody virus Commun ca- t ons w l fa machines w l break down there l be no transport TV stations w l go off the air, and people wil d e of boredom! Co ns w crumb e to dust! P ast c cut ery from highway service stations w ll change hands for nf ated sums t w l be the End of C vil zation as We Know It "

You re overwrought! It s not come to that yet '

'No but t will," I said dismal y Has t occurred to you that we re both carr ers of the disease? The virus must be all over our cloth ng to judge by the damage it s doing to it! Where are we going anyway? A we

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do is spread the infection everywhere!'

Oliver grabbed me by the shoulders. "What else can we do? We have to warn people somehow! Now shut up and keep walking and let me think!"

Eventually we managed to hitch a lift into Bristol. I spent the ride waiting for the car to fall apart but it seemed unaffected. I could only assume that the virus had not in fact been carried on our clothing, but for the life of me I couldn't see how that was possible. The car dropped us at the street corner near Oliver's flat. The door key was a bit mangled but it held together enough to let us in. Oliver headed for the telephone.

Half an hour later he put it down. "Oof. I don't want to have to go through anything like that again!"

What did you do?

"I called the managing director of Decal Electronics and put the position to him. He's agreed to inform the authorities that there has been a sudden and inexplicable incidence of rapid corrosion in the vicinity of North Bristol, resembling an epidemic. Cause as yet *unknown*."

But—"

"But we can reveal the cause only by admitting it is all our fault, and neither you nor I nor Decal Labs would want that. Nor does it do any harm, because Decal will spearhead the investigation."

"I know the managing director. He's a tough bird. If it's possible to get out of this with our necks intact, he'll do it."

"Fine. But what if the disease just keeps spreading? It really *will* be the end of civilization, Olly!"

He looked glumly at his fingernails. "I know. But there's still hope. Have you noticed anything?"

"Like what?"

"Well, for instance, the lights are still working. So was the phone when I put it down." He switched on the hi-fi. It was working too.

"So I hasn't reached here yet."

"No, but we have. *Something* killed off the OGRE virus particles on our clothes. I noticed on the way here that the corrosion seemed to have stopped. I only wish I knew *why*!"

Olly and I did as we'd been told. We stayed put. And we have never felt so useless in our lives. We drank coffee and played records and kept an eye on the TV for new bulletins, all the time half-expecting the percolator to suffer a meltdown and the hi-fi and TV to go on the blink.

It was an eye-opening experience for anyone with a fond belief in the openness of British government. The world was about to grind to a halt, and there was not one word on TV or radio to let the public know.

There were a few hints though. Like an item about a pub in Lennard's Green (just down the road from Menderby) whose beer kegs had suddenly decided they preferred to look like colanders, spraying the clientele with cold lager. Olly groaned aloud at the waste, I suspect. And something horrible had happened to the railway lines near Bristol, but they weren't saying what.

Every so often we got an updated report on the true state of affairs, over the telephone. For the first twenty-four hours the epidemic advanced eastward along a narrow front until it had affected an area about fifteen miles long and two broad. We plotted its progress on a map with pins. It was heading straight for Swindon, an important railway junction, a center for heavy industry with a population of one hundred thousand. So far it had passed only through rural areas, but this would be orders of magnitude worse.

Then the wind changed, and it turned slightly northward, just enough to miss Swindon. But any relief we felt was short lived. Thirty miles along the Thames Valley right in its path, was Oxford.

Oxford isn't just dreaming spires and ivory towers. In addition to the University, Oxford has motor works, steel works and printing presses. OGRE was going to make an awful mess of those.

The advancing front had narrowed again to less than a mile. There were fewer damage reports coming in, but it's a very rural area and so it was hard to tell whether that was significant.

We waited. It was torture.

The phone rang. Olly beat me to it by a nose. He didn't say anything, he just stood there with a funny look on his face, shaking his head slowly from side to side. It didn't look very encouraging.

He put the telephone down. He looked stunned.

"Don't tell me," I said. "Oxford's in ruins. The British Leyland plant at Cowley is a scrap heap. All the University computers are wrecked, and they're suing Decal for every penny they've—"

"No," he said. "Not yet, anyway. Oxford hasn't suffered any damage yet. The plague seems to have stopped spreading somewhere between Bampton and Kingston Bagpuize."

"Why? Has the wind dropped?"

"No, it's blowing a gale. I just don't understand it."

"Perhaps it's voodoo."

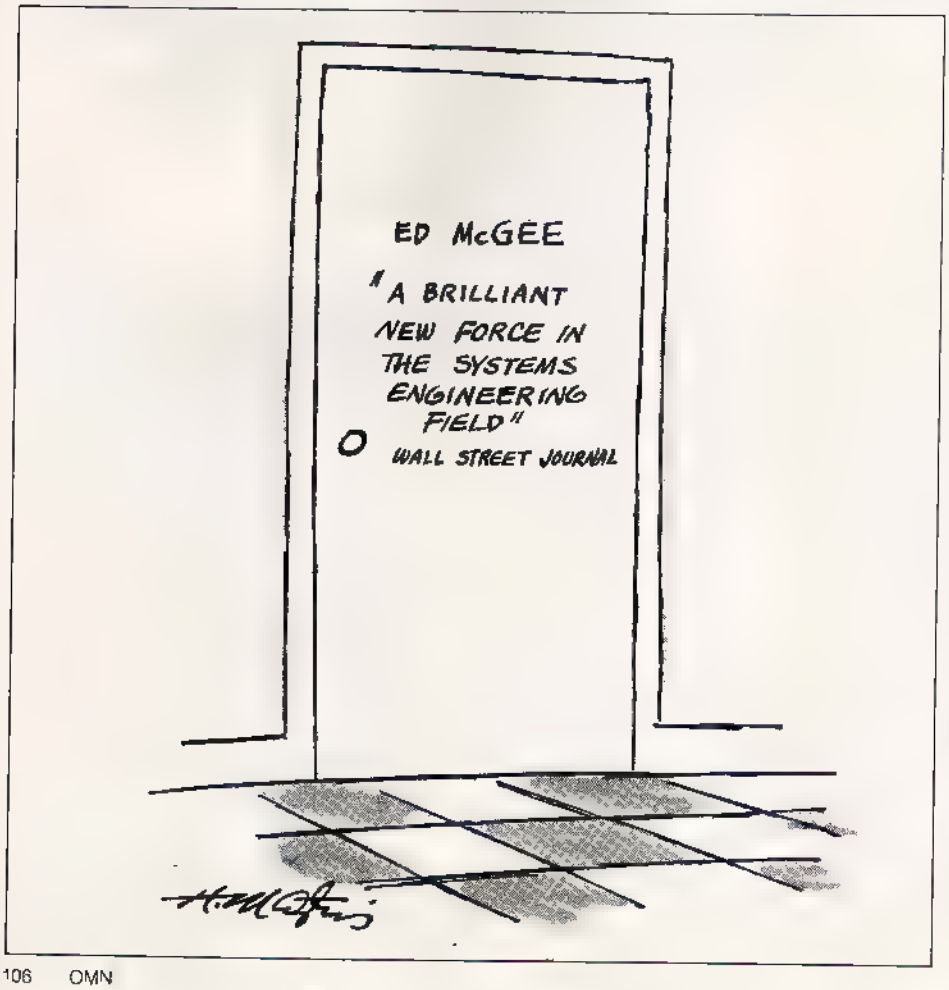
"Eh?"

I waved vaguely toward the map. "All those pins we've stuck into it have killed it."

The area of active infection began to shrink. Within forty-eight hours reports had ceased altogether.

Something had wiped out Oliver's artificial virus. But we still had no idea what had really happened, or even whether it would *stay* wiped out. Oliver was whisked off to Decal's Manchester branch to assist the inquiries, and I was patted on the head and sent home. I drove back to Coventry with my fingers crossed, and I took a detour east of Oxford, just in case.

There was never even the barest hint of a



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whisper in the newspapers not a pussycat as my father used to say) but from various sources I pieced together a fair picture. The plague of the metal eaters had confined itself to a region of some fifty square miles, largely open fields, and most of the damage was superficial. It had died out before anything really serious happened.

The newspapers knew something odd had occurred, of course. But they'd been fed some tale about national security, and the government had slapped a D-notice on the story. So they had shut up. (There's no press censorship in Great Britain. There are merely some stories that the papers are not permitted to print.)

By the time I managed to get in touch with Oliver again, things were pretty much back to normal, but he looked distinctly subdued, even a shade *thinner* than his usual degree of roundity, and told him so.

"I'm surprised you aren't mad at me," I added.

"So am I. But the thing that stopped the plague also destroyed the evidence. It's been officially classified as a natural disaster. Of course, Deca Labs chaired the committee that made the final report. That may have had something to do with it."

"They sacked you, of course. I *think* I might be able to wangle you a job in—"

"Eh? Good Lord, no. Deca got a huge contract for reconstruction work!"

"There just ain't no such thing as justice in this cruel world, no more. Oliver, please, the suspense is agony. What *did* stop the plague from taking over the entire planet?"

"Cheap Hong Kong [illegible] from the corner of his mouth."

"Come again?"

"Those and our Earth, British made."

"Stop being obscure."

"Very well. It was rust."

"*Rust*?"

"Exactly. It's a good job you're such a skinflint, only prepared to invest a pittance in my sound business ventures. The prototype OGRE was made of cheap steel. Not too many generations down the components got so small that they rusted away faster than new ones got built."

"I said your inability to scale the microscopic structure would cause trouble! It's precious hard to make a layer of paint less than one molecule thick. And that's the last time I invest a penny in one of your sound business ventures, you ungrateful—"

"Oh, hold on there. I know exactly what went wrong. You have to expect a few teething troubles! We can have another go now, using Japanese equipment in stainless steel casings—" His voice trailed off.

"*Never!* Oliver Boswell Gurney, I refuse!"

"Oh, perhaps you're right. OGRE had too many bugs."

"You can say that again!"

"Anyway, Deca Labs is sending me off to Paris for a few months. To recuperate. Probably the real reason is to get me out of the country. Thus I won't see you for a bit. Can I buy you a pint before I go?"

"No, thanks."

"Have a malt whisky. A treble."

So that was the end of Oliver's metal-eating virus. It rusted away. We should've known. The bodywork always goes first.

So it seems.

But since Oliver left I've never been quite convinced. You see, viruses can mutate. Suppose one of the nth generation OGRES spread its own program and built its offspring out of gold or platinum or stainless steel? Or suppose one learned to copy anything. When the rust killed off the plague it would leave a few members of a rust-resistant strain.

It would take time for their numbers to build up again, especially if they required source materials or were trapped in an unsuitable environment, like an overcoat pocket, for instance. There could be tiny reservoirs of infection remaining, ready to flare up when the conditions became right. And an enormous OGRE. That would be a truly fearful device.

I'm probably worrying needlessly.

If only Oliver hadn't gone to *Paris*, the idea would never have entered my head.

You see, there was a report on television this evening.

The Eiffel Tower just fell down.

The French authorities have attributed it to metal fatigue.

I hope they're right. ∞

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LARGE LION

CONTINUED FROM PAGE 81

can travel through the vacuum of space only at the speed of light they cannot ever decelerate.

About 1,000 years after the Big Bang neutrinos would be moving slowly enough to be trapped in the gravitational field created by their own rest mass and would break up into flat clumps eventually measuring 60 million light years across.

By the time protons, neutrons and electrons formed they would be caught in the gravitational field already set up by the neutrinos and would settle down along the cluster shapes created by the neutrinos.

Astronomers have not been certain until now about how matter managed to collect into galactic clusters. Apparently the Big Bang sent out matter and energy evenly in all directions. The preliminary clumping of neutrinos, which can happen only if neutrinos have mass, may supply an answer. The mass of the neutrino may explain the size and shape of galactic clusters. The gravitational field of the neutrino skeleton would supply the additional gravity needed to explain why the cluster holds together.

One final point. Scientists have been trying to detect neutrinos radiating outward from the sun. However, astronomers can detect at most only one third the number that theory suggests exist. There appears to be no easy explanation.

If neutrinos have mass, then different kinds of neutrinos - three kinds are known now - may be moving back and forth.

The devices used for finding neutrinos can discover only one kind. The assumption has been that only that *one kind* is produced by the sun and *only* that one kind reaches us across the space between the sun and ourselves.

Still, even if only one kind is produced, that one kind, in its voyage across space between Earth and the sun, will oscillate into other undetectable varieties. Only a fraction will at any one moment be in a detectable form. This would explain why we detect fewer neutrinos than we had thought we ought to, under the old neutrinos-have-no-mass axiom.

If neutrinos have a very small rest mass, then the universe would be closed, and that explains the Big Bang. It would explain how the matter of the universe settled out into galactic clusters, why the galactic clusters are the size and shape they are, how the galactic clusters hold together, and finally why the sun seems to be short of neutrinos.

To be sure, the experiments that seem to show neutrinos have mass may yet be found to be false alarms and neutrinos may be forced to return to their status as massless particles. If that proves to be so, what a shame. Their mass would explain so much, their masslessness would mystify.

Don't leave, little mouse. Don't go! The lion needs you! ∞

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EARTH

CONTINUED FROM PAGE 16

wildlife. So far 1.25 million acres has been pledged by landowners nationwide. Hawk maintains that 80 percent of the wildlife he manages already feed upon private land and as his example shows, marginal land can be used without cutting farm production.

The beauty of the idea is that the landowner maintains control of his own land and, if all goes well, will receive tax breaks. Wildlife, Hawk asserts, is a resource worth cultivating like corn, wheat or cattle.

Farmers have been reluctant to make their land available to wildlife for two reasons. First, their property will attract tourists and, instead of tending to business, they would have to patrol the area. Second, farmers fear that when land abounds with wildlife the government buys it and takes it out of production.

When talking to landowners, Hawk tries to dissuade them from claiming that wildlife competes with crops and livestock. He shows them how healthy wildlife is an asset to the community. Life breeds life. What Hyde is trying to tell us is that all we have to do to reap a fuller harvest is to listen.

On Hawk's ranch, some 25 percent of the land has been converted back to wetland marshes, the way it used to be before his uncle drained it to make hayfields. The groundwater there is cold and the climate is harsh. In summer there is frost. In the past, Yams and other ranchers in the area had been plagued with grasshoppers and mice. But because of Hawk's ecosystem, his beef production is up 50 percent.

The standing water in his marshes, heated by the sun, acts as a reservoir of heat and has actually moderated the climate. Water for irrigation is warmer. So is the air, and there is less summer frost, which helps the grass to grow. The wild animals come into the marshes to prey upon the pests.

The coyote is as useful a tool as a shovel or a pickup, Hawk says. He's a rodent catcher. You see, our idea of coyote management is to keep them well fed. In fifty years we've never lost a calf to a coyote.

Dayton O. Hyde is on the road now talking to ranchers, farmers, sportsmen and timber producers around the country, trying to sell them and the government the idea of the Wildlife Stronghold. But it's not a tough sale to anyone who has seen that lake and walked along its shore with Hawk and old yellow dog and a wolf.

When you get out there in a canoe and the moon comes up over Caimus Mountain, there is a golden path between you and the moon. Then the wolf howls and fills this whole earth with that mournful music of his, and you know why you've done all these things. When my time finally comes, I hope to have the guts to go out there in the middle of the lake in a canoe and quietly tip over. Until then, I'm going to fight every day for wildlife. ☐

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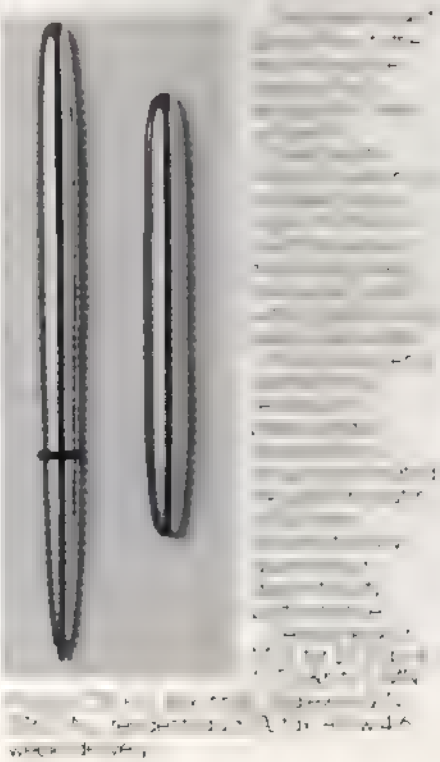

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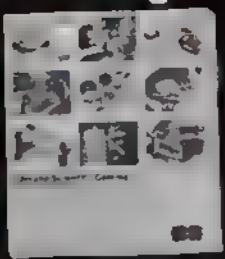

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SPACE

CONTINUED FROM PAGE 20

100,000 kilometers from Saturn's upper atmosphere. During the flyby, *Voyager 2* will measure the gas giant's atmosphere and rings with a photopolarimeter, the only science instrument on *Voyager 1* that failed. Science instruments are not redundant on the *Voyager* spacecraft, whereas most other components are.

Unlike *Voyager 1*, which will escape from the solar system and have no further planetary encounters, *Voyager 2* will use Saturn's gravity to propel it on to Uranus, arriving on January 24, 1986. One remarkable characteristic of Uranus is its tilted spin axis, which causes the planet to lie nearly on its side for its 84 year trip around the sun. When *Voyager 2* arrives at Uranus, sunlight will bathe only the northern hemisphere. The southern hemisphere remains completely dark. Even so, the spacecraft's flight path permits good coverage of Uranus, its necklace of nine narrow rings and all five of its presently known moons. During this flyby, *Voyager 2* will uncover more information about the ring formations of Uranus; some astronomers think the formations may be the result of small shepherding moonlets.

In a final display of cosmic billiards, *Voyager 2* will proceed to Neptune. Since this flight path by Uranus is near the orbit of Miranda, the innermost Uranian moon, *Voyager 2* will journey within 16,000 kilometers of the small moon — closer than the *Voyager 1* flyby of the Jovian moon Io in March 1979. We know very little about Miranda. Will it be primarily an icy moon or will it contain a mixture of ice and rock?

Since a gravity assisted flight path to Pluto would require *Voyager 2* to fly virtually through the center of Neptune, a rendezvous with Pluto will not be possible. Consequently, a large range of flight path possibilities at Neptune are open and will enable *Voyager 2* — if it survives another eight years — to accomplish many more scientific objectives.

By arriving at Neptune on August 24, 1989, and diving over its north pole at only 7,500 kilometers from the cloud tops, *Voyager 2* will be positioned for a close encounter with Triton, Neptune's largest satellite — five hours later. This unique trajectory, designed to fly through the earth and sun occultation zones of both Neptune and Triton, provides the Robin Hoods of NASA's Jet Propulsion Laboratory in Pasadena, California, a zesty challenge to prove their bowmanship at a target range of 4.5 billion kilometers. The Triton flyby distance of 44,000 kilometers can be reduced by flying closer to Neptune.

The closer *Voyager 2* swings by Neptune, the more its path will curve, allowing it to pass closer to Triton. We want to find out whether huge Triton resembles the Saturnian and Jovian moons and whether it possesses an atmosphere.

After the Neptune rendezvous, *Voyager 2* will leave the solar system, at just over 16 kilometers per second. At this speed, 358 millennia will pass before the robot will fly within one light year of Sirius, the brightest star in the heavens.

It is regrettable that *Voyager 2*'s pictures of Saturn will be followed by the longest dry spell since space exploration began, more than 20 years ago. No planned deep space missions have launch dates before 1985. There has been too little money for maintaining a strong program of unmanned planetary exploration.

One space probe that deserves funding is the Halley Intercept Mission. This will give us our only chance to look at the comet for the next 76 years. When Halley's Comet returns in 1986, the Europeans, the Russians and the Japanese will have spacecraft ready to meet it. Of the technological powers, only the United States may plan to watch from afar. When will Congress realize the United States has much to gain by participating in the Halley's Comet mission? Using sensors to scan the dirty snowball nucleus, we could search for clues to the composition of the early solar system and perhaps to the origin of life itself. Many Americans profess to believe in the value of human growth and evolution; if that is so, then we must also believe in the value of exploring this small corner. ∞

CONTINUED FROM PAGE 28

entertainment medium he has reached his widest audience as a writer actor, director, and lyricist for motion pictures, filmgoers around the world spent a quarter *billion* dollars to see his first half-dozen movies The comedian's latest production is *A History of the World Part One*, which has the potential to be his greatest monetary success, although the critics have given it a lukewarm reception It is also the film that gives Brooks's comic sensibilities their broadest canvas, embracing events from as early as the Dawn of Man to the colonization of space

A movie fanatic with a particular passion for the Marx Brothers Brooks inevitably turned his talents to motion pictures He began his career in vaudeville working any job offered to him from musician to impressionist He eventually found it more of a challenge to write for the fledgling medium of television and did so prolifically concurrently teaming with Carl Reiner to record their best-selling series of Two-Thousand Year-Old Man albums (See July's Last Word for an exclusive interview with the very old man) Brooks's comedic reputation was further embellished when he created the extremely successful *Get Smart* TV show in the mid-1960s

Remarkably the novice Brooks's first two films won him a pair of Oscars *The Critic* was honored as the best animated short subject of 1963 and *The Producers* (1968) won for its brutally funny screenplay about a ruthless theatrical mogul A subsequent Brooks film, *Blazing Saddles* (1974) became one of the top grossing motion pictures of all time, rarefied company it shares with his *Young Frankenstein* released the following year

A History of the World Part One is unquestionably Brooks's most satirical motion picture ("No" he states "there isn't going to be a Part Two I did that just so I could end the movie with some crazy coming attractions) The picture is also something of an experiment the first film Brooks has constructed around a theme rather than around a plot

"The oil shortage was very catalytic in my decision to make a movie like this There's a lot of discontent because the energy situation has accelerated inflation and inflation has created the downtrodden Millions of people talk to themselves in their cars because they're meshugga from not being able to put money away I think they identify with the stricken masses who populate the picture and that they realize that the powers-that-be have rarely given a shit about the common citizen

The focus of Brooks's view is vitriolic many through the ages a massive subject that was necessary not only to make his political points but also to provide a sturdy reliable framework for his mordant satire

"I had a bit of a nervous breakdown after my previous picture, *High Anxiety* Not so you'd notice, because I'm having breakdowns all the time But I discovered that a modern setting was too confining for my nuttiness *Now* we all know, so there's very little stretch You can take great liberties with the past because it's all open to interpretation and with the future because it has yet to happen

"By the same token I didn't want to stay with just *one* period as I did with the Russian Revolution in *The Twelve Chairs* or then in *Blazing Saddles* So I decided to do something like *Intolerance*, D W Griffith's episodic condemnation of hatred *Intolerance* was made in 1916 and it's a very long and somber movie not only because it's about Babylon and the advent of Christianity and Renaissance France and other periods, but because anyone named David *Wark* Griffith was *meant* to make movies like that You don't give a kid a name like Wark and then let him become a filmmaker

But I feel you can get rid of people's pain and depression and insecurity more effectively with humor, dragging it from inside them and slapping hard Despots and bigots can be made more vulnerable because you paint them as the ridiculous figures they are Not only that, but while Wark had to wait until he was dead for history to write him love letters you know right away with comedy if you've hit your mark If someone tells you 'That's very interesting' that's *very* good you know it stinks If they spit out their popcorn and roll on the ground, you know you've done the job You know you're dangerous"

BROOKS UNCHAINED

Brooks *is* dangerous, likewise it is dangerous to *be* Brooks He has been relentlessly criticized for the brand of comedy that seems to get him the biggest belly laughs his allegedly vulgar iconoclasm It is an approach he uses freely in his new picture to parody some of history's most pivotal or stately historical phenomena, including the Spanish Inquisition which he's turned into a Busby Berkeley production number ("What could *do*?" he wails When I started writing it I said to myself it sings!") and Lincoln's emancipation of the slaves The comedian is also braced for a fresh round of censuring over his impious portrayals of Moses and the water at the Last Supper

"People will twist you into a pretzel," he sighs, pulling at fistfuls of imaginary dough "Somebody'll say 'Mel, hit 'em where it hurts!' while somebody else'll say, 'Mel that's rude and tasteless' I do what I think is funny and makes the point then hurl myself on the steps of a synagogue and pray to God that my feelings are correct and that people will celebrate what I've done to their minds"

Among the less controversial historical settings used in the film are the prehistoric

The Institute for Psychic Research is two blocks down on the right"

world, the Roman Empire, a Viking funeral and the French Revolution. "It was too bad," Brooks comments on his selection, "that we had to drop so many exciting periods. At first I tried to stay away from things that Stanley Kubrick and Cecil B. DeMille had already covered, which would have left me with a three-minute movie about the Hawley-Smoot Tariff of 1930."

So I cast off that restriction, but I ran into other problems. I loved the Black Plague, but we already had the Inquisition. The American Revolution was also wonderful, but it was really a merchant rebellion and didn't have the passion of the French Revolution, which was a *people* uprising. Brooks adds that Nazi Germany also appealed to him, but he skipped the Second World War to save it for the U-boat picture he hopes to make after he recuperates from *History of the World*.

Even when the selections had been completed, the length of each segment was a problem. Brooks had wanted to make everything 20 minutes long, but he found that impossible. "Comedy doesn't work well against the rubber walls of fantasy, and so I could only hit the Bible quickly—it's kind of crazy in itself with all the miracles—and the cavemen are on for only twelve minutes because there's not enough behavior or structure to refer to or sustain it. Yet I couldn't *stop* writing the Roman Empire. When you have those stone walls of *fact*, there's so much you can do with it personally," he said seriously.

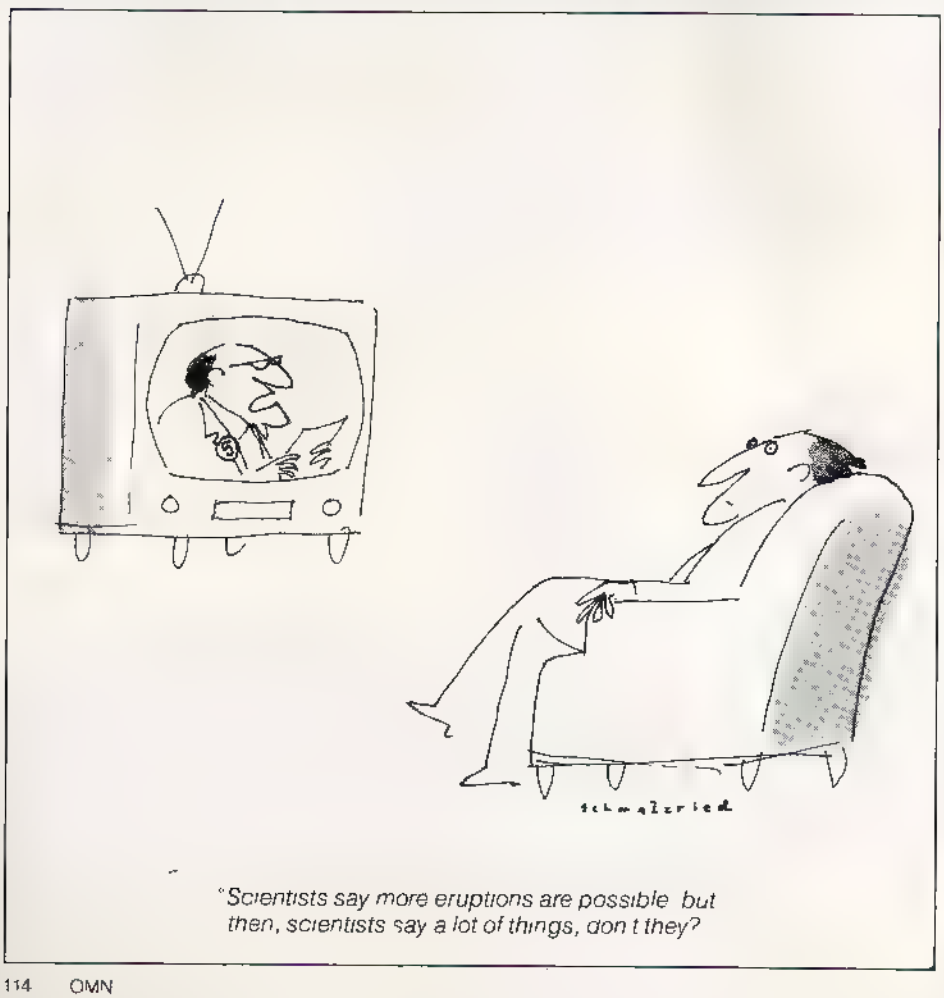
However, Brooks confesses that there is one noncomedic subject he'd consider tackling on his own: time travel. "Not only does the subject fascinate him, but Brooks also expresses an affection for science fiction that's second only to his adoration of Groucho Marx and Kim Stanley (whom he describes as his "father figure"). "I love science fiction because it allows you to create an ark of creativity between what is now and what could be. You can project and prepare for how we're going to make things better or play cheerleader while the bombs fall. There are very talented people writing that stuff, though Ray Bradbury has always been my favorite and *The Martian Chronicles* one of my bibles. Before him there were Edward Bellamy and Aldous Huxley. H. G. Wells also fascinated me. When I was a kid, the movie they made from his book *Things to Come* was the most exciting picture I'd seen since *Frankenstein* came out."

Time travel, though, is by far the most interesting concept I've come across in science fiction. "Not only is it the most serious kind of displacement a person can experience, but the thought that events may actually be frozen behind us and ahead of us thrills me. If something you do is trapped in a warp, even though you're here and not there, then maybe time and not matter is the fundamental reality, the only things that are interred with your bones are an expensive suit and a lot of preservatives."

But time travel stories rarely fulfill the promise of the subject matter. *Time after Time* came close, with Jack the Ripper and Wells coming to the present, but it's more exciting when a character with foreknowledge inhabits the past, smartassing his way through the story by telling all the other characters what they're going to do next. Jack Finney probably handled that theme best in his novel *Time and Again*. "But it's never enough just to get an idea in science fiction or any field. You need people who know what to do with it."

Until he finds the right story, Brooks is content to stay within his all-but-patented realm of irreverent comedy. "What I write comes from my heart and from my soul. Though dramatic films have a certain poignancy, comedy can be *very* serious. Like confronting racial prejudice in *Blazing Saddles* or creating a symbolic Promised Planet for 'Jews in Space.' I'm *on* that spaceship in spirit just as I'm Jacques the Pissboy in the French Revolution or the people on the rack in the 'Inquisition' segment. I think other people will identify with these things too, which is what's most important to me."

"Commercial success is nice, critical acclaim is wonderful, but what really matters is *people*." He deferentially waves a hand toward a copy of *Omni*. "Also smart aliens like Michael Rennie. I think," he says with import, "that a history of the world just *may be* a history of the universe in microcosm." Wise guy. **DO**



"Scientists say more eruptions are possible, but then, scientists say a lot of things, don't they?

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FORUM

CONT NUED FROM PAGE 14

broom stand ng on end at the vortex When shown photos of the broom Dr Char es Tart, of the Un versity of Ca forn a at Davis found t difficult to exp ain with trickery un less there were magnets n the broom Us ng two sens tives who had never prev ously vis ted the vortex asked them to stand outside and record the r mpressions of the energy of the p ace They both felt themse ves wanting to move with the same s ghtly wobbling motion that the broom d sp ays. find such coincidences hard to exp ain by tr ckery

made an effort to gather reports from as many mpart al observers as poss b e (which Hyman did not do) When my studies were done I acqu red a report by state geo og st Earl Nixon, written n the early 1940s that stated many of the same th ngs reported

I do not support a the claims made by the peop e at the vortex I cannot substan t ate its affecting a rplanes passing over head I am also aware of suggestion and il us on, as s any good perception re searcher No doubt to capita ze on tour sm they do exaggerate That s why the sc entific method was nvented If you want to focus on vortex areas why not sup port some good stud es? Look at an mal behavior and p ant growth What about the broom phenomenon? f an Oregon state geolog st us ng proper instruments finds things that Mr Morris s camera doesn t (my photos show different things from Morris's by the way) then I suggest that more research needs to be done, because two independent researchers have arrived at conf cting views That s what science is about

James A Swan, Ph D
Pres dent Life Systems
Educat onal Foundation
Seattle Wash

Ray Hyman replies *Dr Swan has certainly not allowed his ist of educational and professional credentials to stand in the way of his creative miracle mongering We less insightful beings always felt that balancing a broom was in accord with all the normal laws of physics A broom can be balanced on a floor -e.ther sloped or horizontal— because of the spraying of the broom s bristles In fact the ba ancing act looks more spectacular on a horizontal surface Because of the slope of the bristles the broom stands at nearly a 45 degree angle Martin Gardner describes the trick in his* Encyclopedia of Impromptu Mag c

Dr Swan criticizes my methodology The article in Omni *is not a scientific report nor does it go into any detail about methodology How in the world does Dr Swan know what methods Jerry Andrus and I em ployed? I assume he must have consulted his sensitives He dismisses Jerry and me as "professional debunkers As such [we] cannot be considered scientists" Why not? As he says himself, we judge by the methods employed, not by the titles of those who employ those methods*

And just what is it that makes Jerry and me "professional debunkers"? Neither of us makes a living at "debunking" Nor did we set out to show that there was nothing special about the vortex We tested the claims and found that every one of them is based on phenomena that are perfectly normal Not a single piece of evidence stood up to scrutiny when we created "methods to be objective" Indeed if Dr Swan s camera shows things that differ from ours, it is probably because he failed to use objective methods to ensure that his camera lens was exactly equidistant from both target objects This turns out to be a very tricky problem at the vortex, but it can be solved with proper equipment and a knowledge of surveying

Jerry and I also made an effort to gather "reports from as many impartial observers as poss.ble" The owners of the vortex house however, were none too cooperative After much urging, they mentioned Earl Nixon s report but they wrongly informed us that it was a master s thesis done at Oregon State University We were also given, as another scientific source, John Godwin's Th s Baffling Wor d *(1968 Hart Publishing Company) After describing some of the effects that take place Godwin writes*

"However avidly these miracles are asserted by the promoters of the House of Mystery and by visitors to the site sc entific opinion holds that there is nothing in the so-called vortex that is indeed a baffle ment The House of Mystery is nothing more or less than a house of illusion and it does not defy any of the set laws of nature

"Herbert B Nichols formerly natural sc ence editor of the Chr stian Science Mon tor *effectively deflated the vortex He had visited the spot armed with a carpen ter's level a light meter and a plumb bob, and his report explained that in this locality all was right with the world No, the laws of nature were not awry only the impres sions of the visitors who were victims of optical illusion*

Alternatives

I recently thought of a way for no nukers to stop the prol feration of f ssion reactors These peop e have two alternat ves 1) reduce the nationa consumption of electr c ity by enough to keep our demand w thin the constraints of nonnuclear electrica generation methods (e a no nukers stop us ng electricity) or 2) join the system by buying stock n the ut ty compan es and thereby have a say in the use of fission reactors for product on of electr city

I wonder why these methods haven't been used so far Are the no nukers un imag native, un nformed or afra d?

Boris Kortiak
Bensalem Pa

GAMES

ANSWERS TO GAMES (PAGE 128)

1 Rastelli used the fountain technique for juggling a large number of balls in which half the objects are juggled separately by each hand When a juggler can fountain six balls three in each hand the next step is eight balls and then in Rastelli's case ten Rastelli was not as adept at the Cascade which is the method used for odd numbers of balls

2 "Juniors" are (c) people who have been juggling for three years or less Once learned juggling is never forgotten It's like riding a bicycle Graham says "I've never heard of anyone saying I used to be able to juggle but I can't now That just doesn't happen

THE IMPOSSIBLE BOX REVISITED

Our feature article on magician Jerry Andrus ("Magic Man" May 1981) has drawn quite a response He has received 1 000 orders for his package of optical illusions which included a 12 inch precut Tri-Zona Space Warper and some additional illusory tricks not mentioned in the article (His price has gone up to $4 for the package but you still get more than your money's worth Order your Space Warper from Jerry Andrus at 1638 East First Avenue Albany OR 97321)

We have received more than 1 000 drawings of Andrus's Impossible Box the object in the photograph that opened the story This is the greatest response ever received for a single photograph in *Omni* About 40 readers actually built models of what they thought the box looked like from a different angle and either sent us the models themselves or sent pictures of them One Indiana man Andrew Cook, actually built a full sized reproduction and sent us a picture showing his son standing in the box

We can say that most of the hypotheses we have received are *wrong* They are not the way Andrus's contradictory crate is built although they would create the same illusion We will reveal all—the true construction of the Impossible Box as well as some of the more interesting "wrong" hypotheses readers sent in in next month's Games column ∞

CREDITS

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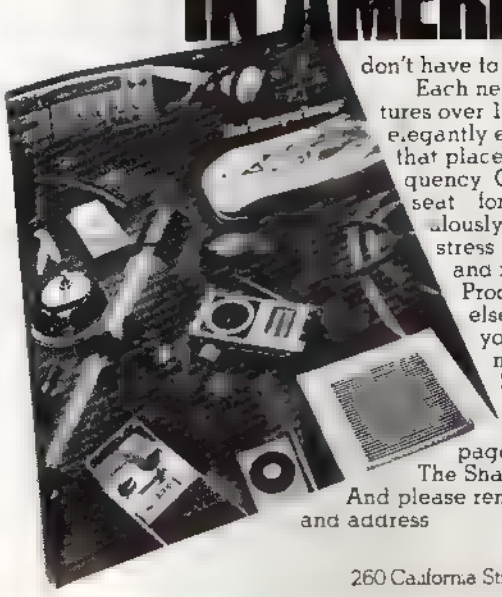
THE CLEVEREST EXECUTIVE TOYS IN AMERICA.



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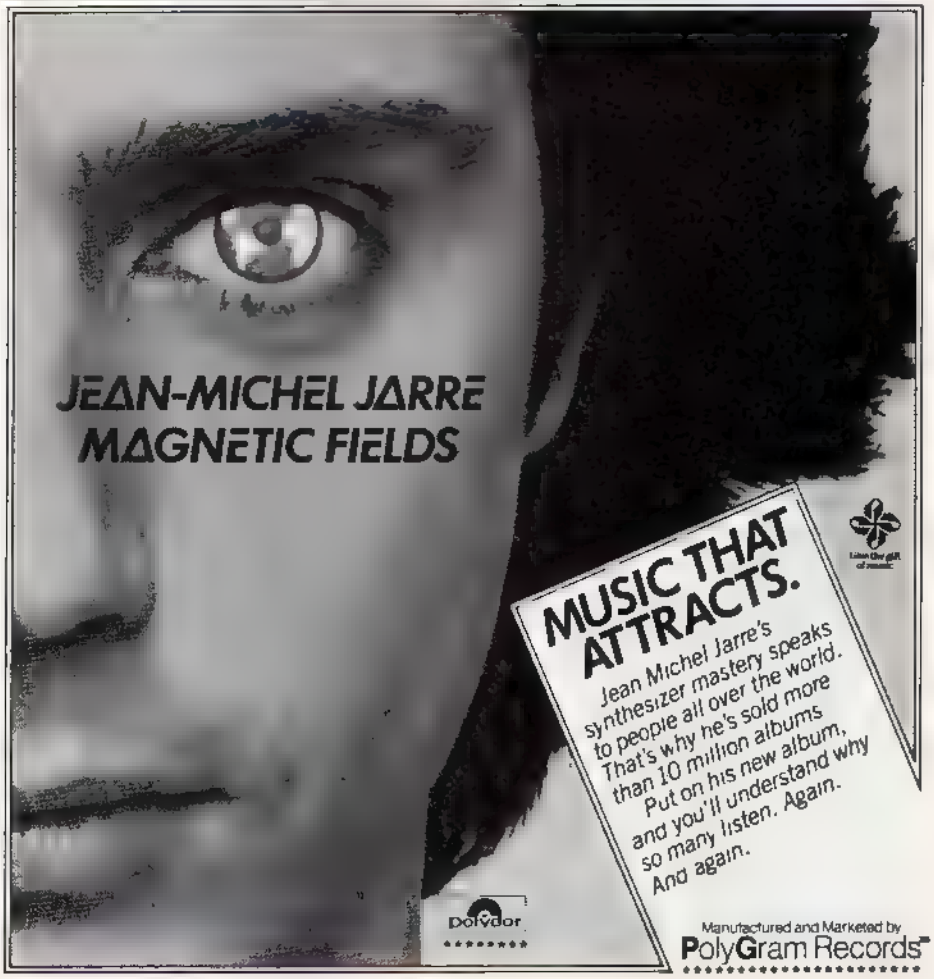
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MODERN MEGALITH

EXPLORATIONS

By Kathleen McAuliffe

On the western coast of Scotland perched high upon a windswept bluff overlooking Glasgow is a circular megalithic structure 40 feet in diameter. This ring of weather-beaten whinstone looks like a mini Stonehenge the artifact of a prodigious race of ancient Britons. **Sighthill** as the monument is known stands out in stark contrast to the factories and blackened chimney stacks that dot the horizon. How did it come to dominate a skyline that is today remembered as the birthplace of the Industrial Revolution?

The secret resides in a time capsule buried deep within the foundations of the central stone. Papers contained there explain that Sighthill does not date back to the Neolithic megaliths of Avebury or to the famed stone rows of Carnac in Brittany. Rather it is Britain's first megalithic observatory to be erected in 3,000 years.

Completed in 1979, Sighthill was commissioned by the Glasgow Parks Department as a tribute to four city scholars who played a pivotal role in exposing the hidden geometry underlying the stone relics of Europe. They are Professor Alexander Thom and his son, Dr. Archie Thom, both engineers by training; Dr. Archie Roy, professor of astronomy at Glasgow University; and Euan MacKie, assistant keeper at the university's Hunterian Museum. Unraveling the mystery of the ancient megaliths has been no easy challenge, even for the Glasgow group. Medieval people thought the great stone monuments had been constructed by giants. As late as the 1920s many antiquarians presumed them to be the work of the Druids — Celtic priests esteemed by Julius Caesar and others for their great wisdom. When radioactive carbon dating finally established that the circles were built between 2900 and 1200 B.C., the world was startled. The stone monuments found scattered from the Mediterranean basin to Scandinavia predated the Druids by a millennium.

Precise measurement of the megaliths age only made their origins more obscure. Was their purpose to mark territorial boundaries, or did they serve some esoteric function in ceremonial rites surrounding birth, death and feast or famine? The full story behind the ancient megaliths may never be known. No writings, not even inscriptions etched on stone, have come down to us.

One thing is certain. Whatever their religious beliefs or the social fabric of their culture, astronomy played an integral part. The stone circles of Britain and northern France are among mankind's first observatories, according to Gerald S. Hawkins, author of *Stonehenge Decoded* (1966), and probably were among the earliest calendars.

Now, thanks to years of painstaking research by Alexander Thom, who together with his son studied more than 400 Neolithic sites, the details of a broader picture have emerged. The stone alignments relate to the movements of the sun, the moon and bright stars.

MacKie's excavations of megalithic sites such as at Kintraw in the Scottish Highlands further bolstered the Thoms' findings. But archaeologists were not easily convinced. Such an interpretation requires a nationwide astronomical program, working with a fixed standard of measurement (what he calls a megalithic yard — 2.72 feet). Moreover, the layouts of later stone rings led Thom to hypothesize that the builders may have possessed knowledge of Pythagorean geometry some 2,000 years before the Greeks. Many experts find impossible the idea that such an advanced society could have existed in prehistoric Europe. Their position is cogently stated by archaeologist Glyn Daniel, writing in a recent issue of *Scientific American*. Many people, no doubt bored by the prosaic account of megaliths to be got from archaeological research, jumped on the Hawkins-Thom bandwagon, accepting the builders of megaliths not only as experts in Pythagorean geometry and possessors of accurate units of mensuration but also as skilled astronomers who studied eclipses, the movements of the moon and the positions of the stars. To me this is a kind of refined academic version of astronaut archaeology.

It is against this backdrop that Duncan Lunan, the Scotsman charged with the design and construction of the new megalith acknowledges an ulterior motive behind the project. "The alignment and layout of Sighthill are entirely derived from prehistoric megaliths, notably the pattern of viewstations around le Grand Menhir Brisé at Carnac. Since many archaeologists still maintain that the ancient sites are not observatories—and ours most certainly is—where does the difference lie?"

To Lunan, an astronomy buff and author of several books, building a contemporary stone circle presented an irresistible challenge. For starters, megaliths are not easy to come by these days. Most modern quarries use fast-burning explosives, such as gelignite, which bring down the rock in small pieces suitable for highway construction. The stones required for Sighthill had to fit a human scale—standing some four to six feet above the ground. Only a slower-burning explosive, such as black powder, would permit the recovery of boulders that size. After combing up and down the west coast of Scotland, the search finally ended at Beltmoss Quarry in Kilsyth, otherwise known as the Back-of-the-Hill Quarry, on Takma-Doon Road. "With a name like that," Lunan remarks, "we should have guessed it would be the last black-powder quarry in all of Scotland."

Then there was the difficulty of hoisting the rocks up to the hilltop. For the smaller stones the Royal Navy came to the rescue with a Sea King helicopter, executing Operation Megalithic Lift in only 35 minutes. The larger rocks were too heavy even for the helicopter; only an earthmover would do. "Inasmuch as the early Britons had only rafts and sledges to move rocks weighing up to sixty tons," Lunan says, "the effort they invested would be comparable to sending a man to the moon today."

Ironically, the ancients had a significant advantage over the modern-day megalith builders in the accuracy of their astronomical layouts. To align stone markers with celestial bodies on the horizon, they probably employed several generations of sentinels who would make their observations from carefully chosen vantage points. The moon, for example, migrates to its most northerly and southerly positions in the sky once every 18.6 years. To mark the lunar "standstills," the point where the moon reverses its apparent motion on the horizon, the early astronomers are thought to have refined their sight lines over a century or more. The prolonged observation time was necessary because fluctuations in temperature and humidity affect refraction. The earth's atmosphere bends light rays so that a celestial object appears higher in the sky than its true theoretical position. The extreme accuracy of the ancient alignments suggests that refraction had to be averaged over a number of lunar standstills.

The Manpower Services, however, had allotted a considerably shorter time scale for the completion of the project. This meant going about the task entirely in reverse. Instead of observing the horizon events, Lunan had to calculate these positions in degrees relative to due north for the exact latitude of Sighthill. Next he had to modify his figures to take into account both refraction and parallax (displacement due to an observer position on the earth's surface other than at its center). Once the precise bearings of key lunar and solar events had been worked out, a surveyor's theodolite was used to pinpoint landmarks on the horizon that coincided with each degree setting. (Chimney stacks and cathedral spires came in handy for this purpose.) The stones were visually aligned with these features, in much the way early peoples may have used prominent notches and peaks on the horizon to aid them in their own arrangements.

As the last stone was positioned, more than 1,000 people turned out for the event, including the press and television crews. All told, 17 stones were incorporated into the layout, which had been scaled down from 40 miles across (the diameter of the view station at Carnac) to 40 feet. The observer at Sighthill is meant to look across the circle, with the marker stone on the far side occluded, and see the event happen over the central stone. If Lunan's calculations were correct, Sighthill would mark the lunar standstills, sunrise and sunset at the summer and winter solstices, and the rising of the bright winter star Rigel—both as it is now and as it appeared in the sky in 1800 B.C.

> *"Considering that builders of megaliths had only sledges to move rocks weighing up to 60 tons, the effort they invested would be comparable to today's space program."*

A full month would pass before the first major test of the Glasgow megalith, summer solstice, and during that suspenseful time Lunan had more than one doubt about the accuracy of his calculations. He considered the precaution of buying a one-way ticket to Buenos Aires. But Sighthill was there to stay; ten-ton concrete foundations would see to that. It would be bad enough to tell the Parks Department that I'd got it wrong, but can you imagine trying to explain it to Professor Thom?"

There was another niggling worry. Should the modern-day megalith builders have blundered, it would serve only to fuel the opposition's argument. "After all," Lunan said, chuckling, "we can't very well maintain that people in the Neolithic and the Bronze Age built astronomically aligned structures if we ourselves failed using twentieth-century technology."

The dramatic moment approaches when the Glasgow team will find out whether its hard work has paid off.

3:30 AM June 21, 1979. Thirty people mount the hill. Black clouds shroud the horizon. A downpour soon scatters the crowd.

10 PM June 21. A dozen people return to catch the setting of the sun at summer solstice. Torrential rains dampen their hopes. Only a few more days to go before the sun will change its course.

3:30 AM June 22. The rising sun draws the hard core enthusiasts back to Sighthill. More rain.

10 PM June 22. The group dwindles. More clouds interspersed with drizzle.

3:30 AM June 23. Sighthill is now a mudslide, but three brave the climb. Their efforts are in vain.

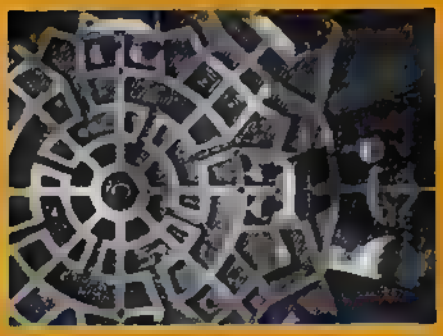
10 PM June 23. A solitary figure makes the treacherous ascent. The sky is sullen and overcast. Miraculously, Lunan's moment of glory arrives. The clouds part, and a great ball of fire sets over the central stone.

While Lunan thinks of his achievement as a blow to critics of archaeoastronomy, it is unlikely to change their views. If they had sought to be converted, the statistics would surely have convinced them by now. Hawkins's computer calculations of Stonehenge's alignments to summer winter solstice and the lunar standstills place a one-in-a-million probability on the boulders appearing in that configuration purely by chance. The Thoms survey of hundreds of Neolithic sites ascribes the likelihood of pure-chance alignments to other stellar events, such as the rising of Capella at still lower probabilities. Why then the staunch refusal to believe that the early inhabitants of Britain possessed sophisticated knowledge of the movements of the sun, the moon and the stars? Presumably, agriculture and navigation would have promoted their interest. Nor is there any reason to believe that prehistoric man was in any way inferior to his latter-day descendants in terms of brain size or intellectual capacity.

Yet doubts linger. My own skepticism stems from a much more practical concern, namely the weather. We are expected to believe that the ancients dragged 60-ton boulders from quarries sometimes more than 200 miles away—*for what?* To stare up at black clouds or die of pneumonia in a torrent of downpour?

"That's not much of a problem," Lunan says. "Three thousand to five thousand years ago Britain had a much better climate. The Greek historian Diodorus says it had excellent weather, with harvests twice a year, when 'the great spherical temple dedicated to Apollo'—probably Stonehenge—was in use. Maybe it's because Britain became colder and wetter that we stopped building astronomical circles—until now!"

NEXT OMNI



FICTION

TECHNOCITY— Quebec, now. What American metropolis adopted place [illegible] over the past [illegible] years. Dr. I. M. Levy, [illegible] and [illegible] Science, Culture [illegible] Technocity, [illegible] Now, starting [illegible] September [illegible]

CLARKE EXCLUSIVE – After the great success of *2001*, Arthur C. Clarke wrote a treatment for a new movie project. We'd like the next [illegible] Despite Clarke's [illegible] write [illegible] present *The Songs of Distant Earth* in original treatment by Arthur C. Clarke, with artwork by Robert McCall.

SMART FOOTBALLERS— The [illegible] Catch take their tools [illegible] There [illegible] what [illegible] *The People's Almanac* selected [illegible] Football Team of All Time. Not surprisingly, [illegible] Starr, Graham, Warfield, [illegible] Staubach, Stabler, Csonka, Brown, Hirsch, Motley, Otto, [illegible] Wizards routinely [illegible] Many of the [illegible] Wizards [illegible] Dr. Levy and [illegible] Technocity. They'll [illegible] Dr. Levy's [illegible] Wizards [illegible] Football [illegible]

PARTICLE-BEAM WEAPONRY— [illegible] both the United States [illegible] particle-beam weapons [illegible] Brookhaven National Laboratory. One [illegible] Particle Beam Weapons [illegible] of [illegible] might prove [illegible] Star Wars [illegible] ComSat [illegible] Read about [illegible] next issue of *Omni*.

SCIENCE FICTION— George [illegible] Jack Dann [illegible] Dann [illegible] September [illegible] Also in September [illegible] Bruce Sterling [illegible] Wayne Wightman's [illegible] Fighter [illegible]

IQ TEST

38 and [illegible]
39 and below [illegible]

Answer sheets from the 88 Mensa volunteers were scored for the 34 items selected for our test. The distribution of their scores is shown in the table on page 88.

As you can see, no Mensan got all items right. The highest score was only 36. The average (mean) score was 28.91. The median, which 50 percent scored better than, 50 percent worse than, was 29.

The distribution is somewhat bunched up toward the high end, suggesting that the test was too easy for many Mensa members and not sufficiently difficult to differentiate among the smartest of them.

Our test sample was too small and the number of items too few to draw any firm conclusion between test scores and IQ. Still, after a few qualifications, it is possible to make some general estimates.

Not everybody does his or her best at all times. Obviously, some Mensans who took the test may have had a headache or otherwise failed to do their best. Even the best-constructed, most accurately administered individual test has what statisticians call a probable error. This is the amount by which the score might vary if you took the same test on two different occasions. Many psychologists therefore prefer to give IQ scores in a range and not as a specific number, allowing for the probability that a retest would show a different score.

With that in mind, you may convert test scores to IQs as follows:

- With a score of 20 up to 23, your IQ is probably in the "25 to "3" range. This is slightly below the level required for Mensa qualification (defined as the upper 2 percent of the population), but this one test score is still on a par with that of several certified Mensans.
- A score of 24 to 28 translates to an IQ range of 132 to "39. This approaches the middle of the Mensa range. You would have a good chance of qualifying.
- A score of 29 to 33 corresponds to an IQ between about 140 and "47. This is a very strong showing. You have an excellent chance of qualifying.
- A score of 34 or over suggests an IQ of "48 or above. Were you to take the Mensa test, you would almost certainly qualify.

Scores on this test are not accepted by Mensa or any other [illegible] but they can indicate what you might expect if you [illegible] Some people [illegible] with other intelligent people; others merely want to know whether they can make it. For membership information write Mensa Selection Agency, Dept. O, Suite 1R, 1701 West Third Street, Brooklyn, NY "1223. For $8 they will send you a take-home test. Return the completed test to Mensa and they will respond with a valid IQ report. ∞

LUNAR CHIMERA

STARS

By Allan Hendry

The moon has been dead for 3 billion years. That's why astronomers have been so puzzled by transient lunar phenomena (TLP) glows, mists, and color changes seen on the moon's surface.

Fully 1,400 TLPs have been reported during the last two centuries, according to one count. Yet proof of their existence has been frustratingly elusive. TLPs do not permanently alter the lunar surface, and evidence for them is primarily anecdotal. But scientists have slowly worked out a theory that may explain these events.

TLPs sometimes appear as bright spots even on the moon's unlit region. Others blur surface details up to ten miles across. Sometimes they appear weakly red or blue. While such observations usually last for 20 minutes or so, some persist intermittently for hours. TLPs seem to favor certain craters and the edges of lunar maria; over 300 have been reported from Aristarchus alone.

But these sightings spring chiefly from amateur astronomers, whose observations the professionals often consider suspect. British astronomer Patrick Moore once commented, "We did our best to weed out very unconvincing reports, but it was sometimes difficult to come up with a decision, particularly with the older observations."

One professional search for TLPs seems to rule them out. In 1964 Northwestern University in Evanston, Illinois, backed by a NASA grant, dedicated a 24-inch telescope in New Mexico to a search for lunar events. President Lyndon Johnson described the program in a message to Congress the following year. "The objective is the automatic detection and analysis of lunar phenomena," he said. "Scientific analysis of such phenomena may indicate energy sources on the lunar surface that may be exploited."

A TV camera replaced the telescope's eyepiece, and observers watched a small monitor. That way small differences in contrast could be enhanced electronically, revealing otherwise undetectable changes in surface details. A group of amateur astronomers, called the Argus Astro Net, broadcast their own TLP sightings over shortwave radio, and the New Mexico staff attempted to confirm their claims.

Seven years and 45,000 photographs later, no TLPs had been seen. On a few occasions the moon's brightest features took on a bluish cast that sometimes even covered its entire surface. These were not mainstream TLPs, however, and they were at least partly explainable. In addition to checking most of the 19 Astro-Net claims, the study tried to confirm two dozen independent sightings, all unsuccessfully, despite the generally superior equipment used.

Yet the NASA study has not discouraged serious interest in the subject. At a scientific symposium held in Houston five years ago on lunar activity, the existence of TLPs went uncontested. Winifred Cameron of NASA's Goddard Space Flight Center dismisses 60 percent of the 1,468 TLPs in her catalog as spurious, but she treats the remainder as valid.

Members of the Association of Lunar and Planetary Observers (ALPO) have helped Cameron acquire photographs and photometric and polarization measurements of TLPs. Several Apollo missions saw streamers that indicated a temporary lunar atmosphere. The Soviet astronomer N. A. Kozyrev of the Pulkovo Observatory, in Leningrad, has taken emission spectra of TLPs at Alphonsus and Aristarchus. His findings indicate the presence of molecular carbon, hydrogen, and nitrogen. And Apollo's measurements found concentrations of radioactive gas at sites favored by TLPs. Such uneven distribution points to sporadic venting of gases on the lunar surface. Yet direct measurements don't bear this out.

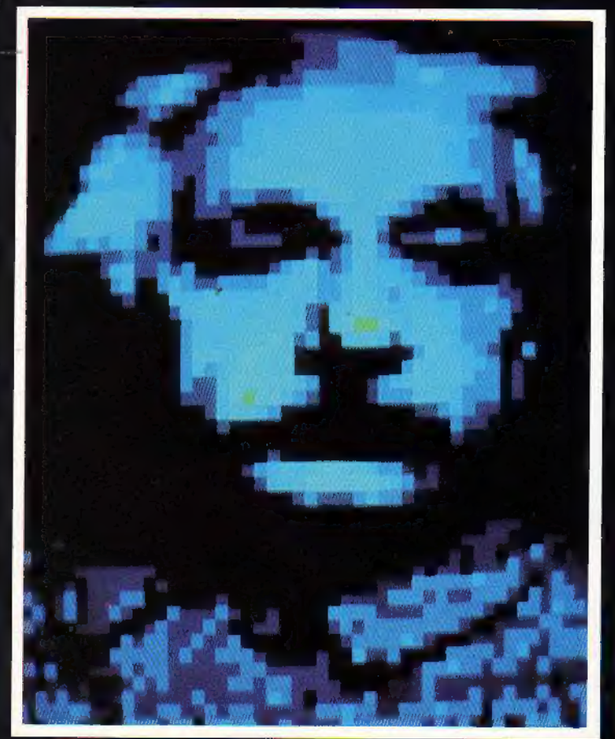
Moon mystery. Things that go flash in the night

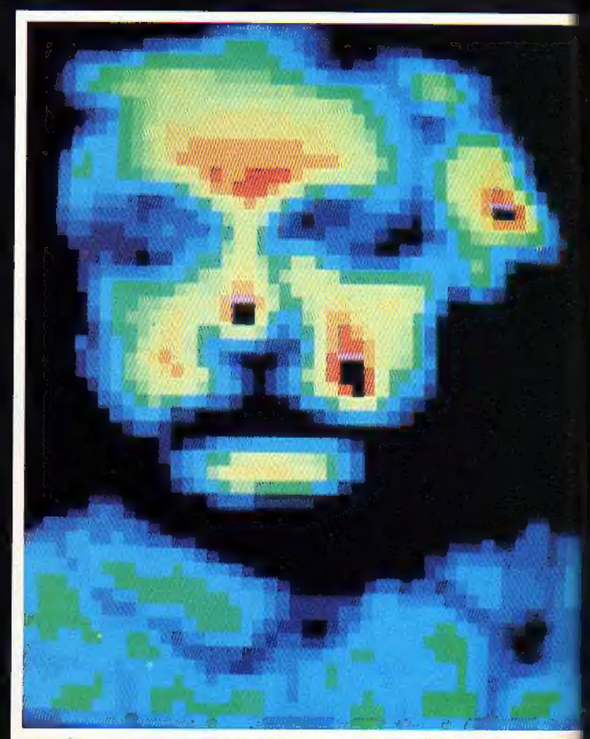
What are TLPs, then? Another theory would have the sunlit side of the moon appear brighter simply because vented gas "fluidizes" the dust on the moon's surface. This would increase the reflection of sunlight by flattening out the spiky structure of the dust layer. The catch is that the change would be semipermanent and would require too much gas.

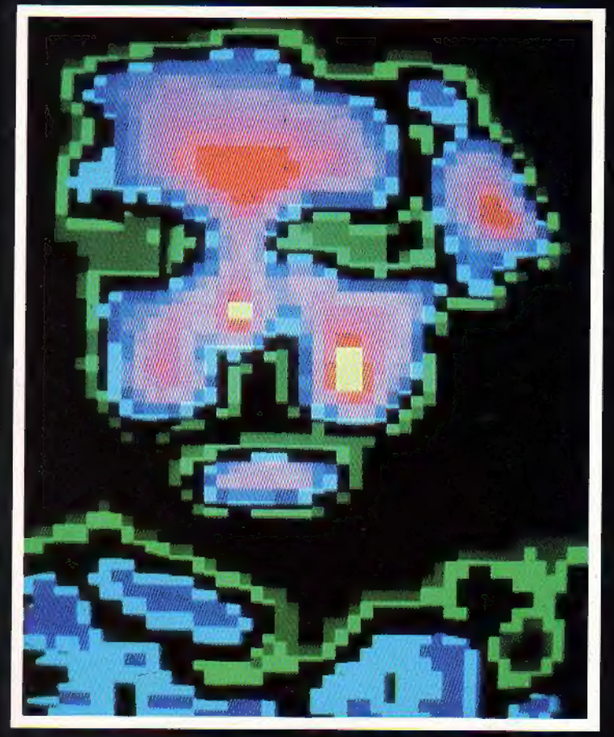
Allan Mills of England's University of Leicester has recently proposed a scheme that requires much less outgassing. The smallest dust particles are blown upward as "moon smoke," without disturbing the structure of the dust below. Sunlight would scatter the particles, with the resulting color and polarization depending upon their size. Then the "smoke" would quickly settle back to the ground, leaving the area unchanged.

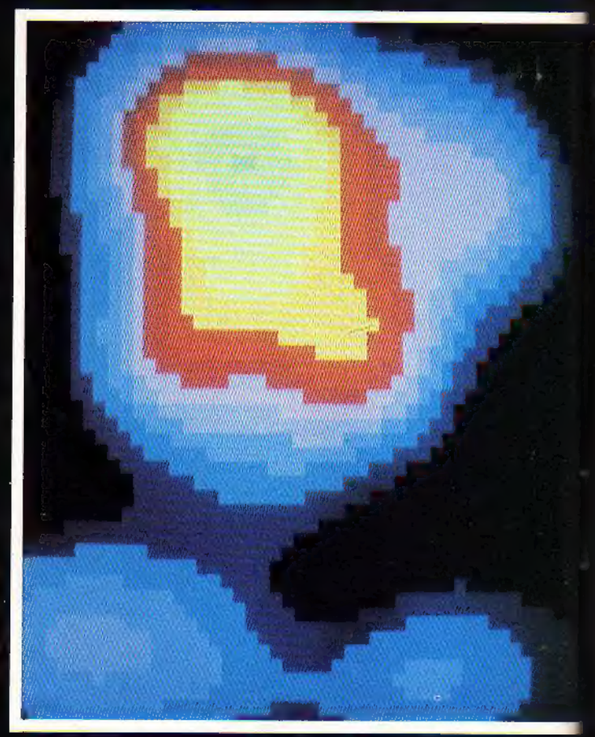
Yet what opens and closes the vents of trapped gas? Mills says it's tidal forces, noting that another study linked TLP activity with the moon's closest approaches to the earth.

Cameron disputes this, noting that the larger her TLP data base grows, the weaker the link becomes. Furthermore, not one of her ALPO observers has ever seen a TLP near a seismic epicenter. Shallow moonquakes are a more probable cause, she thinks. Cameron asserts that individual TLP features possess separate correlations to orbital position, sunrise, solar flare activity, and other factors. Still, she agrees that a gentle outgassing causes these enigmatic incidents. ∞









PHENOMENA

In this visual metamorphosis, color enhancement has stripped a black-and-white portrait of Albert Einstein down to the physicist's essential features. German photographer and science-fiction writer Herbert W. Franke used a computer program to digitize the scales of gray on the original photograph. Then, in a series of six steps, Franke added vibrant color to each gray scale. This process transforms the photo into a luminous composition while retaining the minimum criteria needed to recognize Einstein's presence. A direct interface between computer and video display enabled Franke to photograph succeeding versions of the portrait with a Rolleiflex camera and an 80mm Planar lens. Franke envisioned Einstein's aura and, through computer technology, recorded the results on Ektachrome daylight film.∞

"Look, Ma, I'm jugglin'!"

GAMES

By Scot Morris

"The laws are all the same for everybody. Nature sets the rules."
—Sergei Ignatov, champion juggler

QUIZ QUESTION 1: The man considered to be the best juggler of all time was Enrico Rastelli, who died in 1931 at thirty-four. He could juggle ten balls—a world's record that still stands—yet he was never able to juggle nine. From the information appearing later in this column, can you figure out why?

QUIZ QUESTION 2: In the International Jugglers Association (IJA), a "Juniors" competition is for: (a) people under twelve years old, (b) people under sixteen, (c) people who have been juggling less than three years.

Juggling—the sport and the art form—is enjoying a renaissance. More people juggle now than ever before—not just on street corners, but also on campuses and in laboratory hallways. Balls and clubs are flying at Stanford, Harvard, and M.I.T.—where one scientist even tried to build a juggling robot. Mathematicians and computer scientists are drawn to the patterns and structure of juggling. "They also like the control," says Ronald L. Graham, head of the discrete mathematics department at Bell Labs, "getting things to do what you want them to do and to come out right—like a neat computer algorithm." Graham keeps a 15-foot-square net dangling from the ceiling of his office. When it's time to toss, he lowers the net around himself and can practice without having to chase after the inevitable drops. He can juggle six balls proficiently and is working on seven.

We cannot give an adequate juggling lesson in this short space, but we can offer a few general tips—such as the obvious one of practicing with one ball, then two, before advancing to three. The balls should be uniform in shape, size, and color. They should have some "heft": Tennis balls are too light, but lacrosse balls are about right. We prefer bean bags; they're easy to catch and don't roll all over the floor. (An excellent set of three red, spherical juggling bags, machine-washable and -dryable, can be bought for $16, postage included, from Brian Dubé, 7-13 Washington Square North, Apt. 47-B, New York, NY 10003.)

Practice over a bed. Practice while facing a solid-color wall. Contrary to what one might think, juggling is (or should be) a two-dimensional activity: Use only the vertical and the left-right axes. As soon as throws go out of this plane, forward or back, you're in trouble.

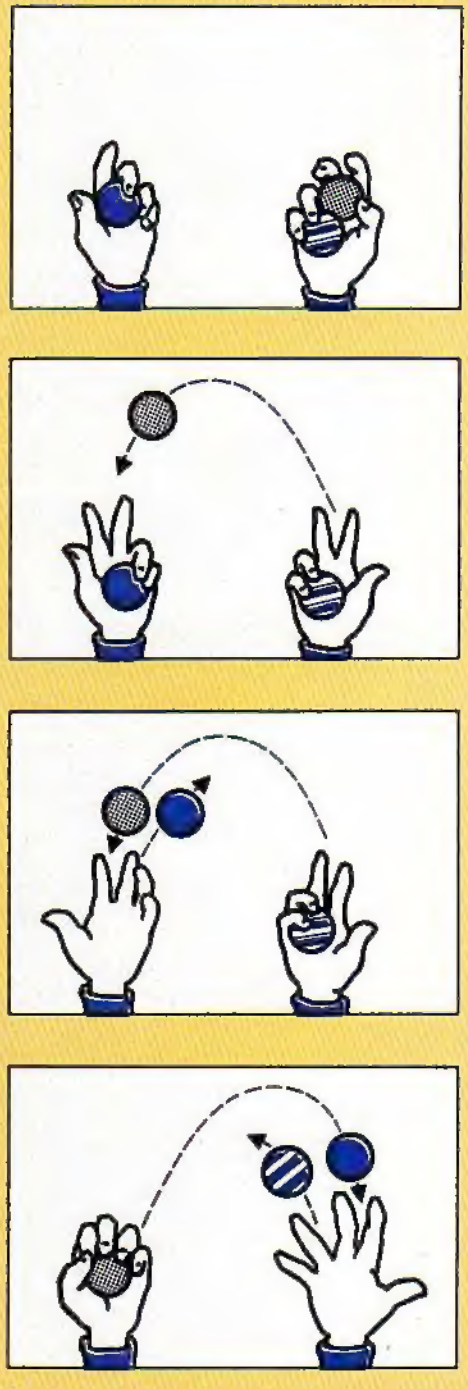
The commonest problem is throwing the balls too far out in front of you, so that catches have to be made with an extended arm. (This can be worked into an asset in "joggling." See Jugglemania, at right.) Concentrate on where you're putting each toss—it should pop out of the hand, without spinning, and pass just to the inside of the arc of a ball coming down. The second-commonest mistake is reaching up and catching too high. Remember: Gravity still works. Let the balls come to you.

Beginners get frustrated by not being able to get anything started. Everything seems to go too fast. One instructor recommends slowing down gravity by practicing with silk handkerchiefs, which float through the air more slowly than balls do. Another technique is to roll the balls on a tilted table: At low angles they'll travel in a slow, wide parabola. When you get the hang of this, increase the tilt gradually. This is called the Galilean technique because it was supposedly devised by Galileo in his studies of the motion of falling bodies.

THE THREE BASIC PATTERNS

Juggling has traditionally been compared to the flow of water, a good analogy from which are derived several terms constituting the basic patterns:

The Shower. One hand does all the throwing, the other hand catches and passes back to the first hand: The balls follow each other around in a circular pattern. This is the technique most people learn first, though it is relatively inefficient and inflexible. A few professional jugglers can shower six balls, which is the modern



The Cascade: Once learned, never forgotten.

Ignatov sets a world's record: Count 'em.

record (there are some curious photos from the 1930s of Tongan women showering seven and eight balls, but the pictures may have been staged).

The Cascade. This is the "professional" method, also recommended for beginners, which is illustrated on page 128. Objects crisscross, each following the path of an "infinity sign." Both hands throw, and catch, in symmetrical fashion. The cascade works best for odd numbers of objects. Several expert jugglers can cascade nine balls, the current world's record for this technique. The most objects ever juggled (indisputably) is 11 hoops in a cascade by the thirty-year-old star of the Moscow Circus, Sergei Ignatov, shown, setting his record, at left.

As shown in the sketches, start with two balls in your right hand (reverse the directions if you're a leftie). Toss one of these toward your left hand. As soon as this ball begins its descent, toss the ball in your left hand to the inside of the first ball's arc. Make the third throw in a similar fashion, as shown. Then stop. Did you catch all three balls? Don't be discouraged: A beginner usually takes 20 to 40 minutes to juggle three balls through one cycle—three throws, three catches.

The Fountain. Also called the columns or pairs technique, it is commonly used for an even number of objects, half of which are juggled separately by each hand. The throws may be simultaneous, or they may be staggered to create the illusion that the objects interweave. The world's record is ten balls with this technique. If you can juggle two balls in your right hand you are usually advised to practice two in the left hand before combining both sides at once. Marcello Truzzi, sociologist and juggler at Eastern Michigan University, says that many students do better by going directly from step one (two in the right hand) to step three (two in each hand simultaneously). "The rhythm of the right hand may help the left get going and do better than it would alone," he says.

JUGGLEMANIA

- The best jugglers publicly perform only the tricks they have mastered. Thus, while Ignatov juggles five hoops "flapjack-style" (end over end) in his act, he may do seven for friends backstage. Rastelli juggled ten balls—five in each hand—but not as a regular part of his act.
- Hoops, balls, clubs: These are the standard juggling implements, in what most people find is the ascending order of difficulty. Thus, a typical skilled juggler might do only four clubs but five balls and six hoops.
- The current world's records are: 11 hoops (Ignatov), 10 balls (Rastelli), 8 clubs (various), and 8 plates (various).
- For "joggling"—juggling three balls while running—current records are 13.6 seconds for the 100-yard dash (Heffler) and 5 minutes 44.7 seconds for the one-mile (barefoot!) run (Lauziere).

IS ANYTHING IMPOSSIBLE?

No one has ever been able to do a sustained juggle with 12 objects of any kind, though with so many people learning to juggle nowadays, that record may be set in the near future. Truzzi, who can juggle five balls, doubts that anyone will ever be able to juggle more than 12 of anything: "Given the speed of objects falling through gravity and the height limits to which humans can throw objects into the air with adequate control, it may be impossible for anyone ever to juggle more than a dozen objects."

Dennis Soldati, ex-IJA president, disagrees. "Ignatov already juggles eleven hoops, and while doing it, he tells me, he's 'thinking thirteen.' He plans to perform with thirteen hoops in about two years."

Accuracy is a problem: The higher you throw a ball the harder it is to get it to land where you want. And then there is gravity. As Graham points out, "If you throw a ball twice as high, that doesn't give you twice as much time but only forty percent more time. The speed gets magnified as the ball comes down." Graham regrets that the astronauts missed a great opportunity to set an 11-ball record on the moon.

For answers to the two quiz questions and a preliminary report on Jerry Andrus's Impossible Box, see page 117.

LAST WORD

By Stephen Robinett

"What I wanted was a shoot-out at the cosmological O.K. Corral. Besides, what would I do with all that popcorn?"

I'm hooked on media events, especially when it comes to science. Recently my passion for them was again roused. Hundreds of reporters converged on a courtroom to bring me—almost live from Sacramento, California—Scopes II!

Oh boy, I thought, *a media event*. I made popcorn. Nell, Kelly, and Kasey Segraves, of the Creation Science Research Center, in San Diego, had filed suit against Charles Darwin and his ilk in the state of California. They claimed the state's 1978 science framework, a written set of guidelines for writers of textbooks, mandated teaching evolution as fact and interfered with schoolchildren's right to religious freedom. The Segraveses wanted the framework redrafted toward "neutrality" concerning the origins of life.

The state argued that the Segraveses actually wanted scientific creationism taught along with evolution—in California's view, a violation of the First Amendment's provision against the establishment of a state religion.

In denying California's motion to dismiss the case, Judge Irving H. Perluss called the confrontation a classic conflict between the free-exercise and establishment clauses of the First Amendment.

I was going to get a classic conflict! The Segraveses, playing the role of William Jennings Bryan in Scopes I, would attack evolution as state religion, secular humanism, and the principal cause of Communism, atheism, prostitution, and drug abuse in today's society. The state, playing the role of Clarence Darrow, would attack creationism as a pseudoscience designed to prove only a priori religious beliefs. I, playing H. L. Mencken, would watch it all—Scopes II!

What happened? It fizzled.

No torrid cross-examinations, no impassioned summations. It all boiled down to bickering over one feeble sentence in California's science framework. Evolution "has been going on so long that it has produced all the groups and kinds of plants and animals now living as well as others that have become extinct."

The Segraveses wanted "Recent studies indicate" added to the beginning of the sentence. Everyone said okay.

That was it? What a rook! I wanted a shoot-out at the cosmological O.K. Corral. Besides, what was I going to do with all that popcorn?

I decided to stage my own event, a mini-media event.

I called Nell Segraves, founder of the Creation Science Research Center. She read to me for ten minutes, ticking off the points creationists won in the suit: new hope for First Amendment religious freedom, new hope for academic freedom, new hope for a free flow of information.

What did I care about hope, new or used? I wanted a media event. Didn't they? No, though news coverage did serve an educational function.

Education—bah! I wanted conflict, drama, entertainment: a media event.

I called Richard Turner, the creationists' attorney, a government-law specialist. What happened to my media event? I wanted to know. Didn't he prepare for it? No. He anticipated bad press, prejudice against fundamentalists, but no more. He said his clients were satisfied with the outcome. I wasn't.

I called Carl Sagan. I wanted at least one media star in my event. I pleaded for two minutes of his time. No luck. Too busy. Carl would be off to Europe shortly, to be in someone else's media event.

I called Robert Tyler, the state's deputy attorney general. He said the suit was "a triviality with no need to be litigated." Where was my event?

He had no idea. California prepared for a lawsuit, not an event. Ignore the media? That made me mad.

I called Clarence Darrow and asked his opinion.

"Here we find today," Darrow said, "as brazen an attempt to destroy learning as was ever made in the Middle Ages."

Now that was more like it! Iron words!

I thanked Darrow, ate popcorn, and called William Jennings Bryan, Silver Tongue of the Platte. What did he think?

"I have never felt a great deal of interest," said Bryan, "in the effort that has been made to dispute the Bible by the speculations of men."

I called H. L. Mencken, asking him to comment on Bryan.

"His one yearning," said H.L., "is to keep his yokels heated up—to lead his forlorn mob of imbeciles against the foe."

Bliss! My media event was happening, right before my very ears!

I thanked Mencken and called Charles Darwin. I asked about California's 1978 science framework.

"I see no good reason," Chuck said, "why the views in this volume should shock the religious feelings of anyone."

I said they evidently shocked the Segraveses.

"It is satisfactory," he responded, "as showing how transient such impressions are, to remember that the greatest discovery ever made by man, the law of attraction of gravity, was also attacked by Leibniz as subversive of natural—and, inferentially, of revealed—religion."

I reflected on the event. I remembered a prediction by Deputy Attorney General Tyler. Scopes III, if it came, would result from one of a dozen and a half bills pending in state legislatures, mandating that scientific creationism be taught in tandem with evolution in science classes.

Scopes III—my eyes glazed over in happy anticipation. I decided to stock up on popcorn.

Stephen Robinett is a novelist, lawyer, and West Coast correspondent for Omni. *While he was out getting popcorn, the Arkansas legislature, by a 69–18 vote, passed a bill requiring the teaching of creation theory in science classes.*